SAFETY ON THE "EL"

PRESENTATION

OF THE

BOSTON ELEVATED RAILWAY

FOR THE

ANTHONY N. BRADY MEMORIAL MEDALS AWARD

BOSTON, MASSACHUSETTS

1929

SAFETY ON THE "EL"

Foreword

THE Boston Elevated Railway, in recognition of its outstanding contributions to the safety of its riders and of its employees, was recently awarded the Anthony N. Brady gold memorial medal for its safety record during the year ending Dec. 31, 1928.

Since safety in transportation is of vital interest to the general public, we believe that the presentation of the Boston Elevated Railway in competition for the award merits publication. Safety measures, in their practical application, are not extraneous endeavors superimposed upon an organization, but are an integral part of its functionings. Thus, in a description of the actual application and realization of safety methods, the many and various activities of this railway are visualized and made real. We hope that this book presents a living picture of the Boston Elevated Railway as it is today.

I wish here to state publicly that the truly remarkable record of the Boston Elevated in the reduction and prevention of accidents was made possible only through the splendid co-operation of the men and officials of the Railway. I wish, too, to thank the members of the riding public who, through an understanding of the difficulties of present-day transportation, have contributed to the success of men and management in making the Boston Elevated Railway the safest railway in the United States.

The excellent safety work goes on, as is shown by the last appendix in this book, entitled "Continued Progress During 1929."

Edward Dana

Boston, Mass., May 1, 1930.

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ACCIDENT REDUCTION

ON THE

BOSTON ELEVATED RAILWAY

PREPARED IN COMPETITION
FOR THE
ANTHONY N. BRADY MEMORIAL MEDAL

INTRODUCTION

THE Boston Elevated Railway enters the competition for the Anthony N. Brady award at this time because it is proud of its accomplishments during the year 1928, and confident that its best efforts compare favorably with the efforts of others.

Two fundamental principles have determined the policy of this railway in its safety work:

That safety is an integral part of management and not simply something to be taken care of by a special department charged with the administration of safety features only.

That all specific safety efforts must be preceded by and based upon thorough research and investigation into past accidents and their causes. The hit-and-miss, trial-and-error type of safety work, which uses hope in place of cortical energy, has been discouraged by this railway.

The report is divided into six parts and appendices.

PART I describes briefly, with illustrative examples, the Railway's efforts to obtain the good will, interest and co-operation of the public in the building and operation of the public's first-class property. The success of these efforts is discussed particularly in relation to the large sums of money spent by the Public Trustees for improvements.

PART II. The Railway has originated and carried out numerous engineering devices and methods for the protection of the public in its contact with the Railway's plant. It has also adopted practices of others where possible. This part deals in detail with the results accomplished.

PART III. The Railway has led the entire electric railway industry in research and practice with respect to individual accident

1928

To All "El" Employees

ANOTHER year is opening before us. This is, therefore, an appropriate time to consider what we can do to make the wheels run smoothly during the coming year.

The following are a few suggestions:

1. We can make an outstanding record in reducing accidents.
2. We can avoid giving patrons cause for complaint.
3. We can take an interest in the adjustment of service to meet the changing traffic requirements.
4. We can conserve time and material.
5. We can do our utmost every day.

MAY the New Year bring Health and Happiness to you and yours.

Edward Dana

proneness. As a result of its researches it has obtained original knowledge as to the origin, causes and influences affecting accident proneness, and it has developed sound practices to prevent and remedy this tendency among its employees. This part describes in detail the nature of the basic researches, some of their results, and the methods of organization and practice which the Railway has developed to solve the problem. The discussion relates particularly to surface-car and bus operators, whose accidents to the public occasioned in the past the largest proportion of injury and damage costs.

PART IV. The aims and objects of management are coincident with those of the men who wear uniforms and who operate cars. Information must constantly be given to the employee in as attractive a way as possible, not only to keep him interested in his job, but also to keep him abreast of the times in a constantly developing and improving industry. This part describes in detail the pioneering practices by which the Railway management succeeds in obtaining that living, co-operative employee spirit without which safe public service is impossible.

PART V. In the construction, maintenance and use of all parts of the Railway's plant, the Railway has developed methods designed to protect the life and health of its employees. This part presents the more important aspects of the Railway's activities to safeguard its employees.

PART VI. The justification of endeavor is success.

IN 1928

THE

BOSTON ELEVATED

RAILWAY

OPERATED

52,274,776 MILES

AND CARRIED

604,695,199

PASSENGERS

WITHOUT CAUSING

THE DEATH

OF A

SINGLE CHILD

—

Estimated Number of Children
in Metropolitan Boston,
400,000.

How the Boston Elevated Safeguards the Lives of

ONE MILLION PERSONS DAILY

BACK of every ride you take in matter-of-fact manner on the Boston Elevated system are forces, factors, equipment and human heads and hands that you do not see—all working in closely teamed co-operation to protect you while you ride.

7/2/27

A FULL-PAGE NEWSPAPER ADVERTISEMENT DESIGNED TO STIMULATE SUMMER RIDING

All employees are requested to cooperate in this effort to secure a greater use of our facilities, especially during the summer months

Edward Dana
General Manager.

THIS ADVERTISEMENT WAS REPRODUCED IN POSTER FORM AND MOUNTED ON BULLETIN BOARDS ALL OVER THE PROPERTY

Have the original practices of the Railway (based upon what may appear to be abstruse theories) produced results? This part, in its array of figures, answers with an emphatic "Yes."

Appendices. These contain illustrative material in addition to that used in the body of the presentation.

The Boston Elevated System

From the accident-reduction standpoint the operation of the Boston Elevated system is somewhat complicated. It operates rapid transit lines on elevated structure, in subways and on private right-of-way on the surface; street-railway lines on the surface (both on the highway and on reservations), in subways and on elevated structure, and bus lines in widely scattered sections of its territory. These lines serve not only Boston but twelve other cities and towns as well, the whole covering an area of 94.2 square miles and having a population of 1,385,000.

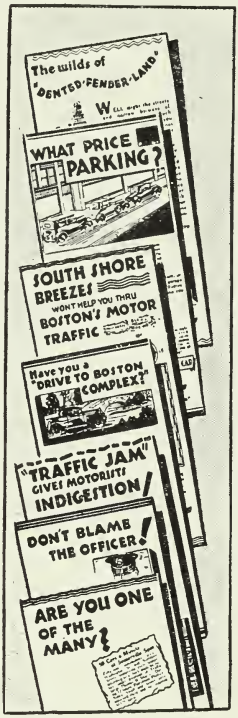
As of Dec. 31, 1928, the following were the facts regarding the track operated by the Railway:

		Miles
Surface track owned		
Plain track		356.401
Special work		42.345
		398.746
Surface track leased		
Plain track and special work		29.106
Operated under traffic rights		4.235
Total surface track		432.087
Rapid transit track		
Owned	48.736	
Leased	8.834	
Total rapid-transit track		57.570
Total track owned and leased		489.657

There are 420.166 miles of track used by trolley cars in public streets and carhouse yard; 11.921 miles of track used by trolley cars in subways and tunnels and on the East Cambridge viaduct,

IT'S UP TO YOU!

Reproduced below in miniature—a series of Boston Elevated advertisements appearing in newspapers during July and August.



If you really like-

DENTED FENDERS
PARKING TAGS
TRAFFIC JAMS
ETC.,,,,,

we cant help you!

BUT-

If you don't like them-

TRY THIS

When you near the city's congested area, leave your car at a convenient garage or parking space and use the Boston Elevated System to take you to your intown destination.

Such accessible points as Forest Hills, Ashmont, Everett, Harvard Sq., Coolidge Corner, Lechmere Sq., Maverick Sq., Governor Sq., and Union Sq. offer ideal facilities to park your traffic worries and use the "EL" System.

BOSTON ELEVATED RAILWAY

Park Your Traffic Worries—Use the "EL" System

Final of The Traffic Series

THIS ADVERTISEMENT SUMMARIZED SEVEN WHICH PRECEDED IT

and 57.57 miles of track used by third-rail trains, making a total of all track of 489.657 miles.

The Railway owns and operates 1,543 surface cars, 528 rapid transit cars and 293 motor buses, making a total of 2,364 passenger cars and buses.

An average of about 1,000,000 cash passengers are carried each day, or more than twice the number carried by all the steam railroads in New England combined.

Approximately 8,500 persons are employed. The annual pay roll is over $16,600,000.

The Railway runs an average of 150,000 revenue car-miles and bus-miles per day.

Public Control

The Boston Elevated Railway is operated by a Board of Public Trustees appointed by the Governor of Massachusetts. It is the largest street railway in the country under government operation.

Under the terms of the Public Control Act passed by the Legislature of Massachusetts in 1918, the Railway is operated upon the basis of service-at-cost.

Neither the stockholders nor the directors have any control over the management of the system.

The Board of Trustees appoints and removes all officers and officials, determines the service and facilities to be furnished, and fixes the rate of fare to be charged.

By direction of the Legislature the rate of carfare shall be sufficient to meet the cost of the service and shall be raised or lowered as may be necessary to conform to that requirement. At present the basic fare is 10 cents, but school pupils are carried for 5 cents and on certain lines a 6¼-cent ticket fare is charged. In 1928, 18.42 per cent of the passengers paid less than 10 cents, and the average rate of fare for all passengers carried was 9.281 cents.

Safety Measures

In the past few years the safety features of the equipment on many railways have been measurably improved. There has been much done also to stimulate the employees to be careful. A large field has remained practically unentered, however, in the analysis of human causes of accidents. It is this field which the Boston Elevated Railway has entered and has proved fruitful. Details of its

researches and the results will follow in this presentation in due course.

In making this presentation the Railway management realizes that achievement in one division of the accident-reduction field, no matter how convincing, is not enough. There must be shown effort and result in all divisions. Study of the Elevated organization as a whole discloses a consistent and successful effort all along the line

PART I

Public Good Will, Interest and Co-operation

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In 1918 the Boston Elevated Railway was given over to the direction of a Board of Public Trustees, acting as representatives of the Governor of the State of Massachusetts. The trustees realized that in order to have efficient, safe service, it was necessary that the equipment should be in first-class order. They have been under the necessity, therefore, of keeping before the minds of the people and authorities of Massachusetts the necessity of expending large sums of money for this purpose. The expenditure of over forty million dollars on track and equipment during the ten years 1918-1928 is proof that their efforts in this direction have been 100 per cent successful.

In 1918 approximately 50 per cent of the surface cars of the Elevated were the old-type box cars, involving constant repairs and impairment of service; 43 per cent of the elevated cars were of wood construction; tracks and switches were of antiquated type and slow service was the order of the day.

During the period from 1918 to 1928 all these things were changed. There were purchased 405 center-entrance cars equipped with multiple-unit control; eighty-one Birney safety cars, equipped with all light-weight safety devices; 471 double-end, light-weight, one or two-man cars, steel construction, with important safety features.

In the rapid transit division a similar program was carried out. This resulted in the scrapping of all of the old wooden cars, substituting fire-proof all-steel cars.

The following tabulation shows approximately what has been spent upon road and equipment, either for entirely new property or for replacement of worn-out property, in order to provide facilities necessary for efficient and economic operation:

Cars and motor buses	$20,115,000.00
Car houses, shops and garages	6,297,000.00
Power houses and transmission of electricity	5,055,000.00
Surface lines (track and line betterment)	5,622,000.00
Elevated structures and appurtenances	2,249,000.00
Miscellaneous improvements	1,443,000.00
Total	$40,781,000.00

CHANGES IN "EL" ROLLING-STOCK IN ELEVEN YEARS

Percentages refer to service based on mileage operated, rendered by the different types of vehicles. Rapid transit is included.

25-ft. Box

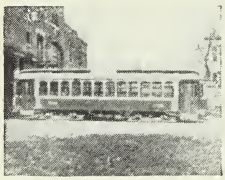
1918	26.5%
1927	0.4%
1928	——

26½-ft. Box

1918	3.4%
1927	0.4%
1928	0.1%

Articulated

1918	9.7%
1927	——
1928	——



Nos. 1, 2 and 3 "Semi"

1918	6.6%
1927	1.5%
1928	1.3%

No. 4 "Semi"

1918	19.4%
1927	9.1%
1928	8.7%

Trailers

1918	3.2%
1927	4.4%
1928	2.9%

Center-entrance

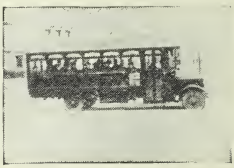
1918	3.9%
1927	18.3%
1928	17.5%

Birney Safety

1918	——
1927	0.4%
1928	0.3%

No. 5 "Semi"

1918	——
1927	29.0%
1928	28.7%



Motor Buses

1918	——
1927	9.7%
1928	10.4%

Rapid Transit

1918	25%	1927	26.3%	1928	29.1%

Foreign Cars

1918	2.3%	1927	0.5%	1928	1.0%

The above for each year total 100 per cent.

Interesting the Public in Accident Prevention

The means taken to interest the public in accident prevention, not only along the lines mentioned but in their own personal relationship as users of the Railway, are as follows:

A. Close co-operation with the Massachusetts Safety Council was fostered; officials of the Railway being on the executive board of that organization. During 1928 the general manager of the Railway was president of the Council. Thus the Railway is looked upon as an outstanding exponent of safety in Boston and its environs.

B. During 1927 and 1928 a series of weekly radio talks were given in order to place before the public some of the operating problems. Suggestions for safety and the extent to which it is a problem of the Railway were constantly mentioned in these talks. This series of talks formed a part of the continuous program of radio publicity carried out for a number of years.

C. The Railway maintains a supply of motion pictures which are used by its representatives or loaned to others for public or local exhibition. Safety is a feature in all these films, which extensively deal with traffic congestion, etc. Extensive use has been made of these films by local organizations.

D. The Railway in its general advertising campaign makes use of local newspapers, billboards and posters. Accident prevention is a prominent feature.

E. The Railway publishes an information and guide folder of Boston which indicates the best way of getting from place to place. By giving free service to the public in the way of information and guidance the Railway cultivates a more favorable public attitude. Thus the public learns to appreciate the efforts of the Railway to serve it and to respond by the orderly use of the Railway property.

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FEWER ACCIDENTS

RESULTING IN PERSONAL INJURIES

IN 1928

THAN IN 1927

Traffic Lanes at Heavily Congested Intersection Conduce to Safety

Influencing the Younger Generation

Not only has an effort been made in appealing to the adults in regard to these matters, but the Railway realizes the importance of influencing the younger generation at a time when they are most impressionable. The accidents to children stealing rides on cars and playing in streets where cars operate have been reduced to zero during 1928, not a single child being killed.

With a view to tackling this problem, a conference was held with the superintendent of schools and the chief of police. This resulted in detailing a special motor-cycle officer to make observations at the opening and closing of schools. As a result of his observation he found that there were children from certain streets who did not have due respect for their own safety. Therefore, during school hours this officer visited the schools in question, talked with the teachers on the subject, and in some places talked directly to the children in class.

Another result was the formation of a Junior Safety Council in the schools, that children might not only be interested in public safety, but in safe habits in all places.

Senior boys of responsible character were selected and, with the consent of the police, performed traffic duty at the opening and close of school at street corners surrounding the school.

Their functions were:

a. To have the children proceed across the street in orderly manner, and not play about in the roadway.

b. To hold up automobile traffic while the children are crossing. The automobile-driving public is in sympathy with the ends of this method and drivers observe the signals of the boys as they do those of regular traffic officers.

Co-operation of local organizations, such as the Kiwanis Club, was secured, and they donated white safety belts to the boys for use while on duty.

PART II

Methods, Devices and Engineering Practices Conducive to Increased Safety, Reduced Maintenance, Greater Reliability

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Methods, Devices and Engineering Practices Conducive to Increased Safety, Reduced Maintenance and Greater Reliability

In approaching the mass of detail involved in a study of the Boston Elevated Railway property with reference to accident reduction it is necessary to classify the information. First, there is the segregation into:

a. Equipment and practices affecting the safety of pedestrians and car riders, and

b. Equipment and practices affecting the safety of employees.

In each case the equipment and practices may relate either to:

1. The transportation department, or
2. Non-transportation departments.

The non-transportation equipment and practices may be classified under several headings as follows:

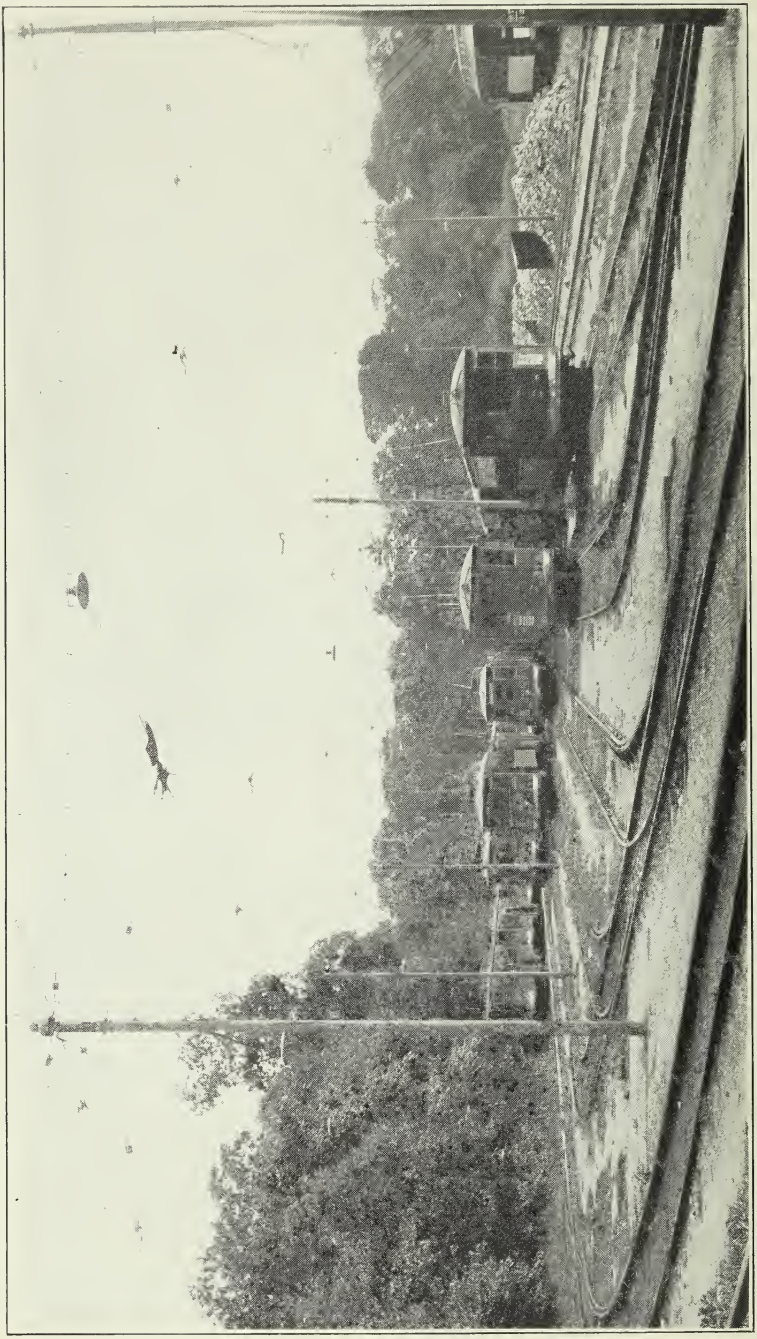
A. Track
B. Cars and buses
C. Shops
D. Stations, etc.
E. Power.

Making the Track Safe for Operation

The Boston Elevated Railway System comprises 420.166 miles of surface track and special work in public streets and carhouse yards used by trolley cars, and 11.921 miles of track in subways, tunnels and on the elevated structure used by trolley cars; and 57.570 miles of track used by third rail trains located on elevated structures, in subways and tunnels, and on open right-of-way.

In 1918, when the Railway came under public control, the surface tracks were of various ages, weights of rail and types of construction. The track in general had spent three-fourths of its useful life. On a large proportion of the tracks "slow orders" were in effect.

As of Dec. 31, 1928, 168.6 miles of surface track has been wholly rebuilt, and 90.9 miles extensively repaired. A large part of the surface track has thus been put into first-class condition, an important element in safety in operation.



Lower Yard Storage Tracks

Safe design and standard surface tracks have much to do with the maintenance of safe track.

The standard construction on the "El" for surface trolley tracks is as follows:

Seven-inch girder or 7¼ inch tee-rail, laid on 6 inch x 8 inch x 8 foot treated hard pine ties, with tie plates; broken-stone ballast; 6 inch concrete paving base. The paving surface may be granite block with grout joints, wood block, brick or asphalt. All joints are welded.

By using better material, by closer inspection, by better maintenance, particularly maintaining the joints with a smooth surface and keeping the special work built up with spot welding and grinding, and by the use of longer switches and larger radius curves at special-work locations the number of derailments has been greatly reduced as well as the number of accidents which formerly resulted from bad pavement. The better and smoother pavement also results in a reduction in accidents to other vehicles on the highway.

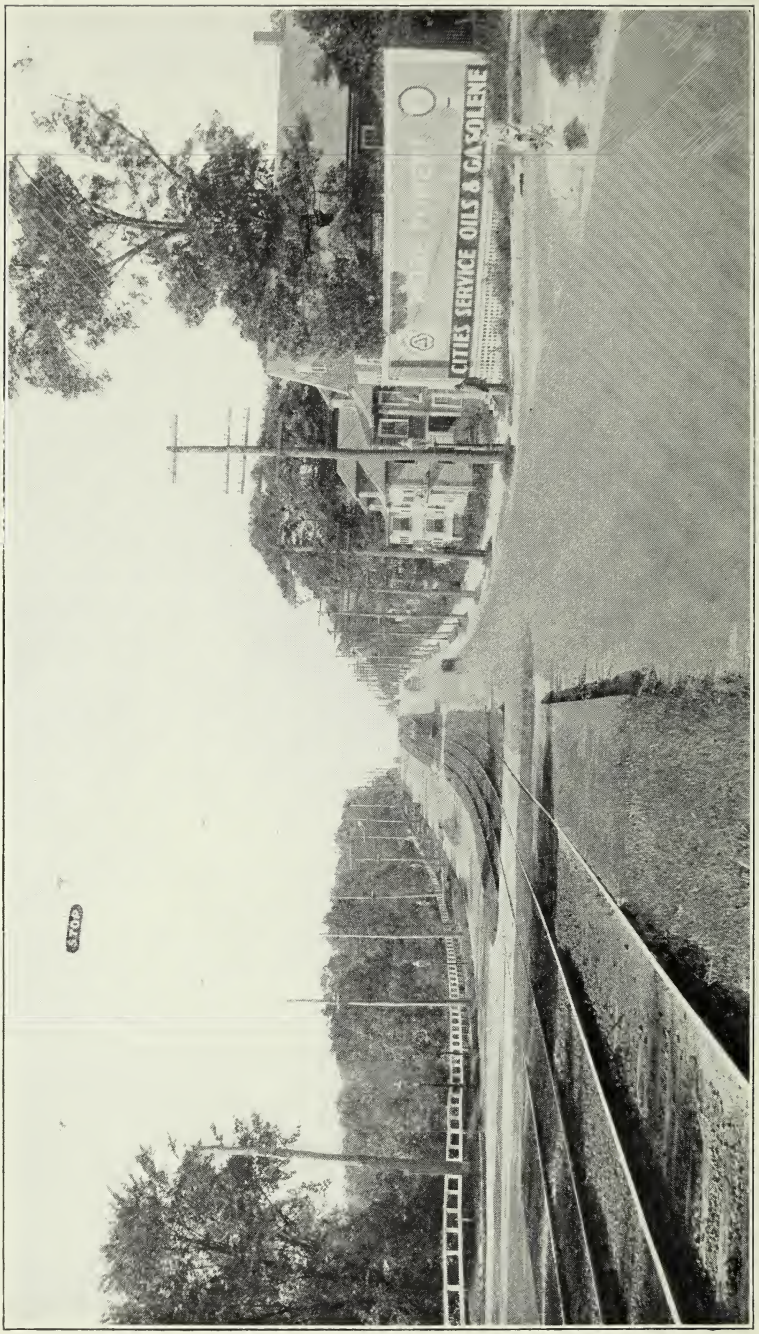
The use of curved head-rail, the tilting of tee-rail with beveled tie plates, and the correct gauging of the track, have resulted in greatly lessened wheel and flange wear, reducing the necessity for turning and grinding wheels and flanges considerably. This, in turn, makes for reduction in derailments due to defective wheels.

In addition to excellence in track design there are other features which contribute to track safety on the "El." Thus, trolley track switches on the main line not controlled by electric switches are locked up with spring switch boxes. The use of keyed switches is practically negligible. Again, flange-bearing special work is used to a great extent for the purpose of reducing derailments and noise.

The Railway standardizes on welded joints, which not only prevent defects in the track at the joint, but insure better conductivity and quieter operation than when cars have to pass over open joints. With certain types of rail also, the ends of the rail are cut on a bevel to carry the wheels over the opening at the rail ends with less damage and noise.

In trolley car yards, the use of heavy tee-rail track and special work instead of the light-weight track and special work formerly used has gone far toward preventing derailments that formerly occurred.

At Clarendon Hill carhouse where the entering track to the yard is on a steep ascending grade, a derailment switch has been



Overhead Stop Sign at Blind Corner

installed to prevent a car getting out of control from running down the hill into the adjoining highway.

The Railway operates over eighty-three bridges in public streets that are owned by either municipalities or steam railroads. Nevertheless these bridges are inspected at least once a year and in some instances more frequently. The owners as well as the Department of Public Utilities are advised of the conditions found.

The Railway operates trolley cars over 45 miles of reservation track or private right-of-way located between highways on either side. In order to prevent other vehicles from entering upon the reservation tracks, which are constructed like steam railroad tracks with tee-rails and ballast, warning signs and fixed blinkers have been installed in many localities. Illuminated signs reading "Reservation for trolley cars only. Do not enter" are used in some instances, attached to the span wires. "Niterday" signals are mounted on standards supported on a concrete base and the standards are equipped with signs reading similarly.

On the reservation tracks the crossings for vehicular traffic are maintained in excellent condition to minimize the danger of vehicles breaking down on the track crossings.

Track-building Equipment, Wrecking Equipment, Etc.

The track-building equipment used by the Maintenance Department is not only modern and entirely sufficient as to quantity, but it is under careful inspection and kept in the best of repair at all times. The use on the public highway, of some of the track-building equipment, such as electric shovels, crane cars, rail cars, etc., makes it necessary to swing the shovel bucket or the crane booms over the traveled highway. This operation is protected by flagmen. As the operators of the equipment are experienced, careful men, practically no accidents to the public have occurred from this cause.

The hauling of 60-foot rails through the public streets on cars, as well as the main girders of the elevated structure on certain occasions, has been done so carefully that no accidents have occurred from this cause.

This excellent record has been achieved partly because the material and the vehicles used in transporting material in the Maintenance Department are handled through one man known as a dispatcher. This one-man dispatching not only minimizes the number of vehicles which have to be used, but assures the materials being delivered when and where wanted.

To All "El" Employees

ON this page for the past two months the message has dealt with the importance of salesmanship. This month it has to do with

SAFE OPERATION.

On page 58 of last month's issue were two aphorisms credited to the Commonwealth Steel Company, an organization in which safety is given a high place. These aphorisms were:

> ***The best safety device is the careful man.***
> ***Let us be wreckless men instead of reckless men.***

There is much of truth in these simple and cleverly worded statements. They stress the importance of the individual in accident prevention.

Every feasible device for promoting safety ought to be used in transportation as in the steel business. But these are of avail only as tools for the safe man.

It may be that the careful man may not always be the wreckless man, but he is many times more likely to be wreckless if he is not reckless.

Edward Dana

Rapid Transit Track and Structure

The rapid transit tracks have always been maintained in good condition, but under public control the track is kept as nearly as possible in perfect condition.

The Railway owns and operates over 12.152 miles of double-track elevated structure. This structure is under constant inspection to detect loose rivets, broken connections, etc. The inspection crew is closely followed by repair crews, and all loose or broken rivets or broken connections are immediately repaired.

On the rapid transit lines all curves of under 2,500 feet radius are equipped with a heavy steel guard rail, firmly attached to the inner rail of the curve and to the ties. This rail is set with reference to the gauge of the track so that the flanges of the wheels do not touch the side of the outer rail. The guard rail is constantly lubricated, thereby allowing the trains or cars to operate around the curve more smoothly and safely.

In addition to the steel guard rail on curves, 8 inch x 8 inch wooden guard timbers are used on all elevated structures outside the track and 6 inch x 6 inch guard timbers inside the track. These are set at proper distances with relation to the rail so that in the event of a train leaving the track for any cause it will drop down on to the ties and be held in line by the guard timbers mentioned above. The guard timbers are fastened to each tie and each tie is firmly bolted to the structure. In certain localities safety guard rails are provided, both on the rapid transit lines and on trolley tracks in reservations and on high embankments, to prevent a train which may be derailed leaving the structure or the high embankment.

On the rapid transit lines and in the trolley car subways, "frictionless" rail is used on the inside of many curves.

Frictionless rail, so-called, is a rail with the head narrower than the standard rail. The use of a narrow-headed rail on the inside of curves permits the trucks to swivel more freely, resulting in smoother operation and less likelihood of a car mounting the outer rail of the curve.

The outer rail on all curves has been suitably elevated to counteract the centrifugal force developed by a car in rounding the curve. This "super-elevation" in each case corresponds with the allowable speed and the radius of the curve.

Scientific as well as practical experiments have been made

over a series of years to determine the safest rail to use on the elevated structure and in subways and tunnels and at the same time to provide as long a life for the rail as possible.

The tracks on the rapid transit lines and in all subways and tunnels, as well as reservation tracks on the open right-of-way used by trolley cars, are under constant supervision. A force of fifty-four trackwalkers, under competent foremen, covering the operating hours, inspects and greases the tracks.

The Department of Public Utilities of the State of Massachusetts, many years ago, fixed the allowable wear of track rails on the rapid transit lines. As soon as the rails begin to show wear on any curve, the measurement of the worn rail is carefully taken and this measurement is repeated at frequent intervals during the life of the rail. In no case is any rail allowed to remain in the track beyond the limit of wear fixed by the Department of Public Utilities.

The rapid transit tracks are also under constant repair, this work going on six nights per week, fifty-two weeks in the year.

Decelerating Track for Derailed Trains

An unusual safety feature at one point on the rapid transit lines is as follows:

At the Everett terminal two tracks extending north of the station are used for turning back trains going in the northerly direction. Beyond the station, the motorman changes ends a relatively short distance from the end of the station platforms where space is limited. The track entering the Everett terminal is on a steep grade, and on two or more occasions the motormen of trains entering the station have failed to make the station stop at the prescribed location and have struck the train standing north of the station.

To prevent such accidents, a "decelerating track" was installed alongside the outbound track. This consists of a turnout, in effect a derailing switch, which is set open when a train is standing on the track north of the station. Should a train fail to make the station stop it would be shunted on to the decelerating track through the turnout described above and would run into a trough built of two heavy timbers firmly fastened to ties and filled with broken stone. To prevent the broken stone becoming caked in ice, during the winter months it is covered with painted canvas. Prior to the installation of this decelerating track, experiments to determine its

effectiveness were made at Forest Hills yard. A 4-car elevated train running at approximately 25 miles per hour was stopped within its own length by the device.

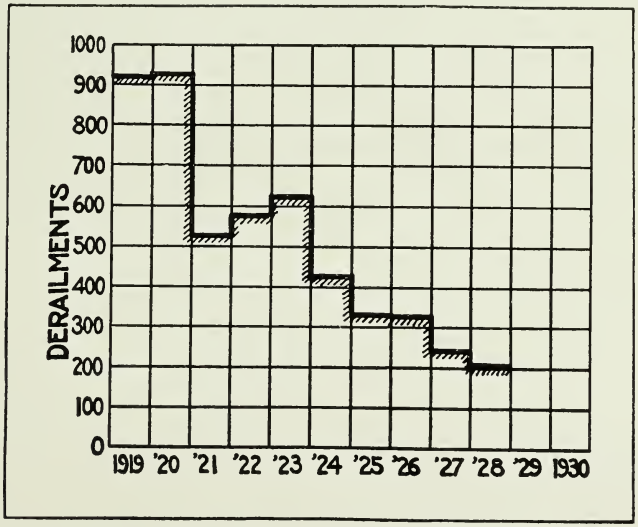
Keeping the Cars on the Track

The 1928 record for derailments made by the Boston Elevated Railway was remarkable for the reduction which it showed over previous years. There has been a consistent improvement in derailments for several years due to the activities of a special interdepartmental committee, which closely studies each accident with a view to eliminating the causes.

A share of the improvement is due to slight modifications in track and overhead construction where difficulty was found in keeping cars on the rails due to track and overhead defects.

The derailment committee contains representatives of the transportation, maintenance, rolling-stock and shops and power departments. Its function is to investigate every derailment and split switch which occurs and determine the cause, and to take appropriate action to prevent repetition. The committee is expected to make a definite finding in each case.

When a derailment or split switch occurs the members are notified. They visit the scene of the trouble and make an investigation. If the cause of the derailment is fully apparent the chairman makes



A Remarkable Reduction in Derailments

a report and recommendations covering the case. If the reason is not evident or the committee fails to agree, a meeting is called by the chairman. The committee assembles with all necessary witnesses, and a more thorough investigation is made. The evidence is weighed, and a decision is reached as to the probable cause. A joint report, with recommendations, is then made and followed up to see that recommendations are carried out.

At the end of 1927, the derailments of that year were analyzed and the general situation was reviewed.

The results of this work are reflected in this comparison: During 1927 there were 243 derailments, costing in claims $15,130.88; during 1928 there were 208 derailments costing in claims $11,548.00.

The work of this committee has resulted in stimulating all departments to do their share in reducing the number of derailments.

A. The transportation department sees that all operators use due care in going over all special work and pay particular attention to the condition of the switches and track, so that they may notice any obstructions likely to cause derailments. When conditions warrant, such as snow, or sudden or heavy rain storms, inspectors and starters call for men from the maintenance department to cover all electric switches for the purpose of keeping them clean and safe for operation.

B. The maintenance department takes great care to see that its track cleaners keep all switches clean, pieces of iron picked up, etc., so that inspection of the track is thorough. Also a daily inspection is made of all electric switches, and a frequent inspection of all switches, to make sure that there are none loose at the heel, that the connecting up points lie evenly in the bed of the switch, and that there is no foreign substance, such as flat pieces of metal, on the tongue. Also, regular inspections are made of special work to see that center plates are neither loose nor broken and that there are no loose joints or broken guards. All curves and switches are properly greased daily.

C. The rolling stock and shops department sees that all flanges are in proper working order, that there are no broken flanges, that wheels are of proper gage, that side bearings are greased and brakes properly adjusted. Thorough inspection is made on a mileage basis.

D. The power department sees that all electrical connections in switches are in proper order, and it has a regular system of in-

spection of all electrical switches. Overhead pans and other mechanism are thoroughly inspected and worked, and defective parts are renewed at once.

As a result of the recommendations of this committee, from time to time, the following things have been done to eliminate derailments:

Seventeen "No Clearance" signs were installed in 1927 at places where there was not proper clearance. These eliminate liability of collisions causing derailment.

Precautionary signs warning operators to reduce speed when approaching switches and curves in yards and at ends of lines have been installed.

Forty-five improved-type pole-box mechanisms have been installed to safeguard electric switches.

One hundred eighteen heavy-duty track boxes have been installed to keep points of tongues in position.

At one place where traffic is heavy a manually controlled switch has been installed.

At another, a ground throw switch and heavy guard rail were installed.

Switches have been changed to include tongues longer than the truck wheel-base to prevent operation between wheels of truck.

Beds of mates and frogs have been built up and ground to take out false points and one-way grooves, especial attention being given to crossovers, curves not regularly used and run-off switches.

On the Viaduct line all wheels have been changed from 24-inch to 26-inch to prevent brake rigging from catching in special work when passing through.

IN 1928

EVERY WEEK DAY

797 CARS

PASSED OVER THE

BUSIEST ELECTRIC SWITCH

ON THE SURFACE LINES

WITHOUT A SINGLE DERAILMENT

—

Total Passages Over Switch
During Year—291,028

On all motors, axle caps and gear casings, common, threaded bolts have been replaced by special heat-treated alloy steel bolts to prevent breakage and consequent derailments.

All cast-iron wheels have been eliminated to prevent the possibility of derailments due to chipped flanges.

As a result of the analysis of 1928 derailments the following recommendations have been made for additional improvements:

That speed and stop signs be installed at danger points on both elevated and surface lines.

That adjustable spring boxes be installed on facing-point switches not electrically operated.

That improved types of throws with coil spring attachments to hold switch point firmly in position on electrically operated switches be installed.

That all men concerned in derailments be immediately interviewed and instructed or disciplined as the case may require.

That changes be made in switch points so that no tongue will be shorter than the wheel-base of car trucks, thus preventing points being thrown by the wheels of the truck.

That constant inspection of all special work by the Maintenance Department be made, and that electric welding and grinding be done to restore worn parts where found necessary.

That special drainage be installed at electric switches where conditions require.

That arrangements be made with municipal authorities to install special drainage at all points where sand and gravel are washed on to the track from side streets with heavy grades during sudden or heavy storms.

That all employees be instructed to keep a sharp watch for obstructions on or near rails, that might cause derailment, and see that they are removed to a safe distance.

FORM USED FOR REPORTING DETAILS OF DERAILMENTS

BOSTON ELEVATED RAILWAY — DERAILMENT No. 685

Date June 14, 1929 — *Weather* Clear and dry

Time	*Car No.*	*Type*	*Div.*	*Delay, Min.*
8:10 A.M.	5201	Semi	One	30 outbound

Location

Ashmont Station, electric switch leading from unloading to loading platform near Dorchester Ave.

Details of Derailment

Rear trucks rode tongue of switch and left rail to right.

CAUSE FIRST REPORTED	CAUSE FOUND AND ACTION
Maintenance Department	
Switch worn at point.	Switch inspected and found worn at point.
Transportation Department	
Car passing through switch at proper speed.	Car passing through switch to the left at proper speed.
Power Department	
No defect found.	Electrical apparatus inspected and found all right.
Rolling Stock and Shops Department	
No defect in car.	Car inspected and found all right.

Report of Joint Committee

Derailment was caused by wheels riding point of tongue of switch about one foot from point. Arrangements have been made to install tongue mate opposite switch in place of present point mate so as to give continuous bearing for outside wheels.

Copy to Gen. Mgr., Transp., Mtce., R. S. & S. Power Depts., Div., and Track Master concerned.

E. A. Kelley,
For Transp. Dept.

B. W. Ellis,
For Maintce. Dept.

Classification of Derailments—1927 and 1928

Transportation Department	*1927*	*1928*	*Decrease*
1. Caused by car collisions	12	8	
2. Caused by vehicle collisions	11	9	
3. Caused by reckless operation	42	35	
4. Caused by switches improperly set	31	28	
	96	80	16
Maintenance Department			
1. Caused by broken rail or switch	12	11	
2. Caused by rail spreading or loose switch	18	16	
3. Caused by worn special work	25	22	
4. Caused by spring switch out of order	17	15	
	72	64	8
Power Department			
1. Caused by electrical overhead trouble	6	5	
2. Caused by electrical underground trouble	8	7	
3. Caused by mechanical trouble	15	13	
	29	25	4

Busiest Electric Switch on Surface Lines

Rolling Stock & Shops Department			
1. Caused by broken flanges	9	7	
2. Caused by improper operation by car shifter	14	13	
3. Caused by broken truck frame or broken shoe falling off	7	6	
	30	26	4
Miscellaneous	16	14	2
Total	243	209	34

In concluding this account of derailment improvement attention is directed to a conspicuously successful result of these studies. By a change in the position of trolley pans, or overhead contactors, used in operating electric track switches, the turning of the switch point while the car is over the switch has been largely eliminated. This causes the type of derailment known as "panning the car ahead." To overcome it the trolley pan was located so as to have the truck of the first car hold the switch point when the trolley of the second car enters the pan. The difficulty referred to occurs when a following car gets too close to the preceding car or when two or more cars are operated in a train, each car using its trolley.

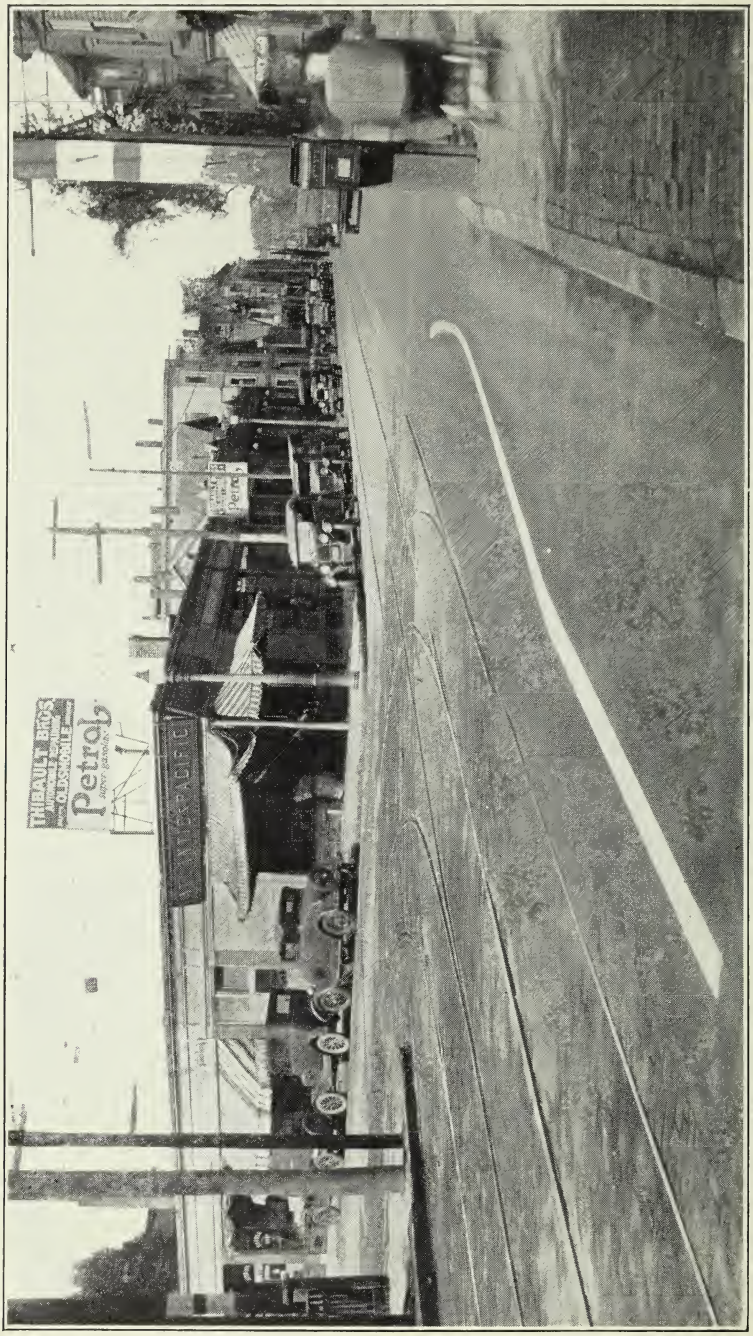
Safeguarding the Public

As a means of warning automobile drivers, pedestrians and car patrons not to come too close to car tracks the Boston Elevated has had excellent success with clearance lines painted on the pavement.

One of the most recent illustrations of the benefits of this practice was in connection with a new traffic artery.

This highway, known as the Northern Artery, reached the point of saturation for vehicular traffic soon after it was opened. Where the Artery crosses Washington Street in Somerville a considerable accident hazard was created and street cars were delayed due to automobiles pulling on to the car tracks. A yellow marker line was painted on the right side of the track for 200 feet on each side of Washington Street, effectively serving as a warning to drivers to keep off the track. It has been a factor in accident reduction.

When this traffic artery was opened, safety zones were installed by the city at traffic points at the right of the running rail. These zones occupied part of the traveled right-of-way and passengers standing there were subject to a danger hazard. To eliminate this hazard and assist in speeding up traffic, center loading areas were established by the Railway between the inbound and



YELLOW CLEARANCE LINES PAINTED ON PAVEMENT

outbound car tracks which are spaced 9 feet 8 inches. These areas were designated by means of yellow lines and are protected by overhead lights and signals attached to the poles located between the tracks.

These center loading areas allow passengers to stand between tracks away from the vehicular traffic, which is not halted while passengers are boarding and alighting. This arrangement has been so successful that the City of Somerville has requested similar installations on Broadway.

Other cities in "El" territory are co-operating in similar ways. Thus in Newton the city has provided a raised concrete platform in Nonantum Square.

The City of Cambridge is now engaged in providing raised concrete platforms at all car stops on Massachusetts Avenue from Waterhouse Street to the Arlington line.

In Arlington, raised safety platforms have been provided by the town near Lake Street, and others are under contemplation.

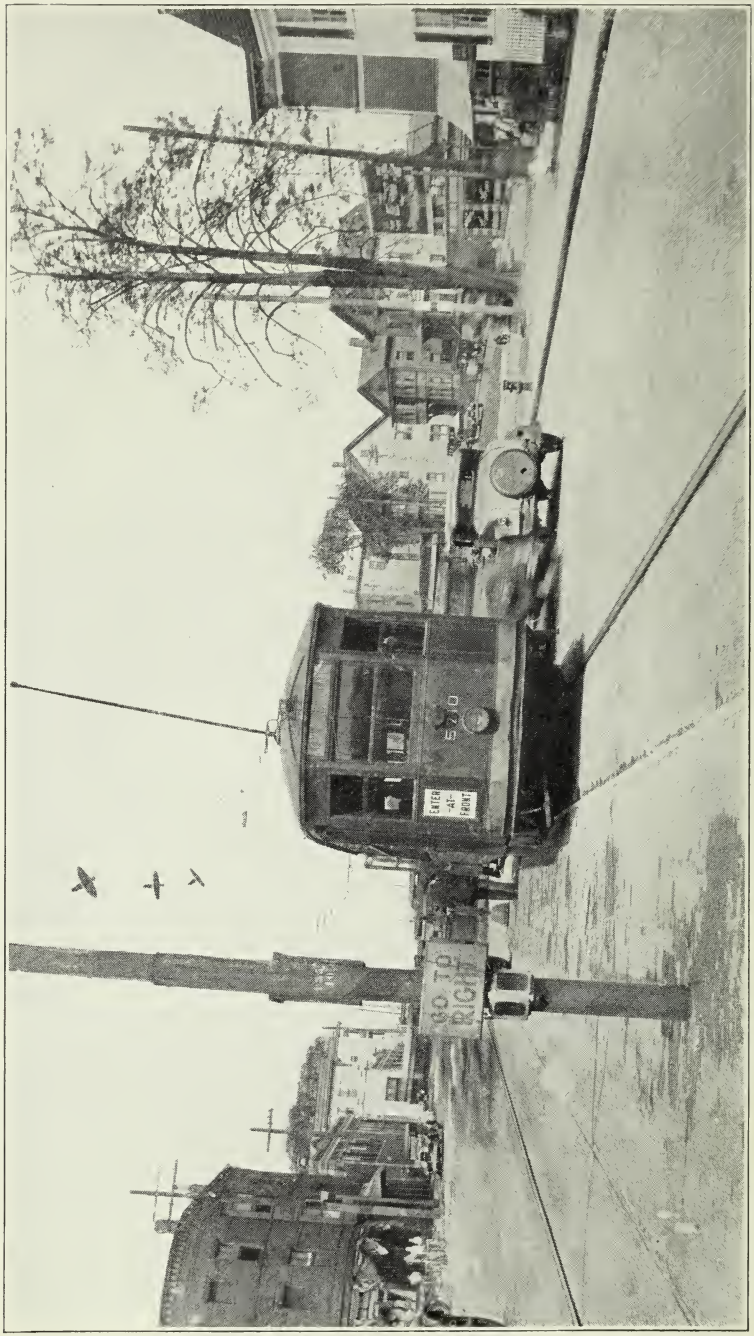
At all of these locations the ends of the raised platforms are further protected by a standard displaying a warning light.

Making the Rolling Stock Safe for the Public

When the Boston Elevated Railway began the operation of buses in 1922, and several years thereafter, the number of accidents on buses per unit of mileage was much greater than that for cars. Part of this condition was due to the comparatively crude vehicles which went by the name of bus even so short a time ago. The first buses delivered were of the truck chassis type with bus body attached, and they were equipped with solid tires. By 1928, however, the record of bus accidents had become highly creditable.

The modern type of bus used by the Elevated has balloon tires, the Railway, it is understood, having been the first operator to apply such tires on buses. This is a safety feature, as the liability of an accident on rough or uneven streets is greatly reduced. The modern bus also has a more liberal floor area, a better distribution of weight and a body constructed of steel and duraluminum.

Every bus of the latest coach type is equipped with a guard to prevent passengers from crowding or interfering with the operator, and no passenger is permitted at any time inside the guard. There is a shade back of the operator to prevent glare in his eyes from the bus lights.



CENTER LOADING AREA ON NORTHERN ARTERY

Fire extinguishers on all buses are inspected daily as are also the emergency doors.

Scrupulous attention is given to the testing of brakes. In the Somerville and Dorchester garages are Cowdrey brake testers. These are electric-motor-driven transmission dynamometers for measuring the braking effort at each braked wheel of a motor vehicle. The reading on the indicator is the road pull in pounds. The co-efficient of friction of a concrete road is reproduced on the brake tester rolls, and the brakes can be adjusted on the machine as if the bus had been tested for brakes under actual road conditions.

One element in the reduction of bus accidents has been the constantly improved maintenance methods employed with buses. For example, a motor room has been established at the Somerville garage where all work of overhauling motors is performed. The Railway also makes its own batteries, having determined by experience that these are more durable than commercial batteries.

An oil-reclaiming outfit has been purchased recently and installed in one of the garages. During the twelve months ending Dec. 31, 1928, a total of 4,189 gallons of oil was reclaimed. It is not only an economy but has resulted in greater cleanliness and in the elimination of what was considered before as a fire hazard.

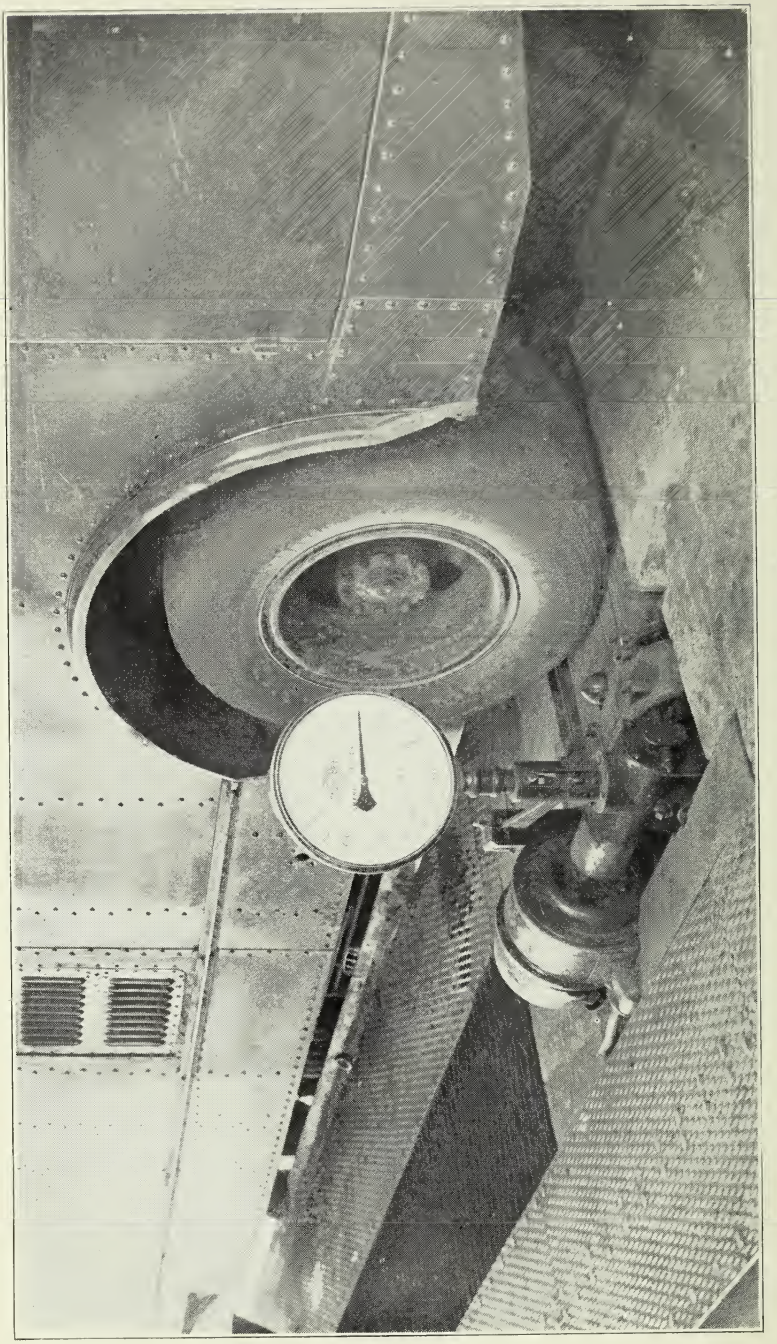
Modern Buses Are Durable

To illustrate the fact that modern bus construction is a factor in accident reduction, a recent incident may be cited. One of the all-steel coaches was struck in the side at the sixth window from the front by a loaded 5-ton truck. The truck skidded 75 feet before striking the coach, which received the full force of the impact at the guard rail. The guard rail was bent, but not a window was broken or a seat disturbed. The coach returned to the garage under its own power, a few minor repairs were made and it was ready for service in the afternoon of the same day.

With a bus of the older wooden type an impact like this would probably have crushed the body in until the truck hit the chassis. Seats would have been crushed in, glass broken due to the racking and bending of the body uprights, etc. The consequences would undoubtedly have been serious.

Cars Have Been Made Much Safer Also

Car accidents on the Boston Elevated have been brought down to a very low figure as detailed elsewhere. Some part at least of



"El" Bus Brakes Are Tested

the improvement is due to the greater reliability of the cars from the accident standpoint. By careful maintenance methods, combined with improved equipment, the department of rolling stock and shops has steadily brought down the number of car and motor defects per unit of mileage. A few of the ways in which improvement has been made in equipment details are cited below. More complete details are given in an appendix.

In the conversion of large semi-convertible cars for one-man operation the safety feature now found in the "El's" new cars was included in the program of rehabilitation. This provides that a passenger, by pulling on a cord, can cause the power to be shut off, the brakes applied and the door engine balanced so that the doors may be opened.

Another safety feature is the installation of window cleaners on 300 surface cars, twelve elevated cars and six Cambridge subway cars. Three years ago the Railway purchased a quantity of window cleaners for surface cars, but they did not prove satisfactory. During the latter part of 1928, however, a more satisfactory type was installed. The men, as a rule, favor a device of this sort.

All subway and elevated cars are equipped with automatic air brakes and all road-bed is equipped with block signals which automatically stop a train if it should run by a danger signal. In several instances motormen's airbrake handles have jammed or broken, making it impossible for the motormen to apply the brakes. Although no accident has resulted from this cause due to the above mentioned safety feature, in the interest of still greater safety an angle cock, connected to the brake pipe, was installed in each cab on all rapid-transit cars. By means of this the motorman can make an emergency application of the brakes even though his airbrake handle is out of order or displaced.

Further illustrations of safety features of car equipment will be found in an appendix.

Door Accidents Nearly Eliminated

The principal class of accidents on rapid transit lines within the control of trainmen is that in which passengers boarding or alighting from cars are struck by, or come in contact with closing doors.

On the rapid transit lines of the Elevated each guard operates the three doors of two cars (at three double platform stations they

operate the doors on both sides of cars) and in the course of an ordinary day's work each guard makes from 960 to 1,440 complete door operations. There are 325,000 door operations in all every day.

Passengers appear unexpectedly from stairways, from behind posts, etc. They change their minds after boarding and back out. They stand in doorways rather than move entirely in or out and they make last-minute attempts to enter or leave cars as doors are closing.

Trainmen are instructed carefully in the handling of doors, and the habits of passengers, and they are constantly warned that they must control their doors as to prevent them from striking passengers.

Among other things they are asked to watch the doors while closing them and be quick to stop or reverse them if necessary to prevent accidents. They must remain between the cars until the train starts, with their heads over the gates, after closing the doors.

Trainmen are required to report every accident connected with doors and every reported case is carefully investigated. If it appears that a guard needs instruction or discipline he is promptly called before the proper official.

In spite of the large number of door operations and the known carelessness of some passengers the door accidents now average less than two per day.

Equipment Testing a Safety Measure

In order to insure reliability of equipment it is necessary that it be carefully tested. For the purpose of testing car equipment a considerable amount of apparatus has recently been installed by the Railway. For example, a device for testing the jumpers which connect the cars of a train has been constructed. This permits the testing of control and electric brake jumpers for partially broken wires or for short-circuited or grounded wires. There is also a motor tester which makes possible the testing of motors at 150% load. Test panels have been provided for testing control relays, contactors, sequence switches and reversers.

Other equipment includes a new triple valve test rack, a new rack for testing feed valves, and a new rack for testing governors.

A section of bench has been piped and wired so that all door engines can be tested after they are overhauled and before they are

installed in the cars. Control arc chutes or similar parts are cleaned here by means of a small sand blast.

Making Stations Safe for Passengers

A part of a station equipment which requires the utmost of care in installation and operation is the escalator or elevator. On the Boston Elevated system there are twenty-eight escalators and four elevators operated in the rapid transit stations. These machines are kept in first-class condition at all times. Eighteen elevator and escalator repairmen are used during the entire 24 hours for this purpose.

Some of the escalators are of the cleat-tread type, others are of the step type. Both ascending and descending types are included in the equipment.

Four years ago work was started upon the design of safety devices to meet the requirement of the new state code for escalators. The essential features of the code include:

For descending-type escalator,

(1) Pawls or equivalent devices to prevent downward movement of the tread or step chain due to reversal or breakage;

(2) A switch to open the motor circuit automatically when a downward movement of the chain takes place.

For ascending-type escalator,

(1) A governor to open the motor circuit automatically when the tread speed exceeds 40 per cent of the normal speed.

(2) A device so applied that in event of the breaking of a tread chain, the treads will come to a gradual stop within a travel of 6 feet, and the motor circuit will be opened at the same time.

EVERY DAY

IN 1928

RAPID-TRANSIT GUARDS

OPENED AND CLOSED CAR DOORS

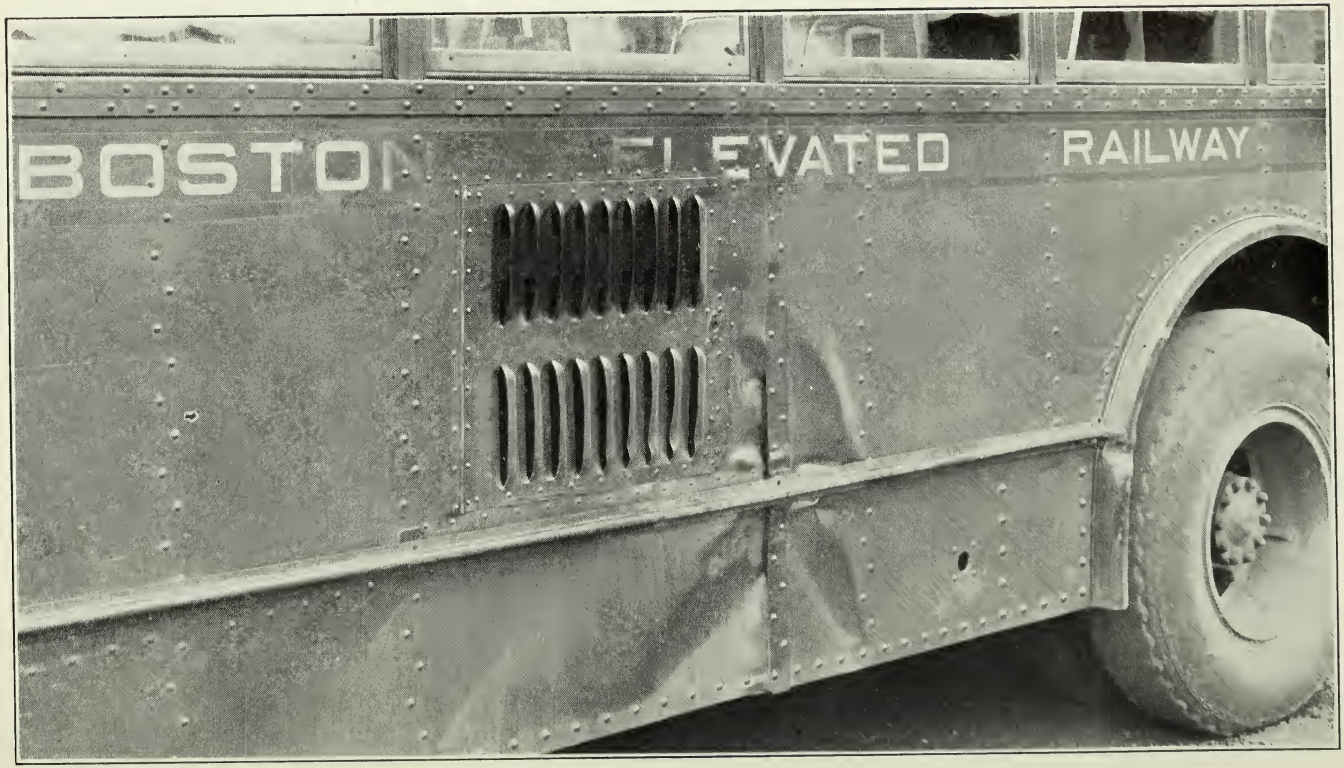
325,000 TIMES

—

FEWER THAN

TWO PASSENGERS A DAY

WERE STRUCK BY DOORS



Slight Damage from what with Older Bus Would Have Been Serious Collision

After preliminary tests the safety devices installed by the engineers of the Boston Elevated Railway were approved and the equipping of all escalators is now nearly complete.

Safer Passenger Transfer at Everett Terminal

Extensive changes and additions have recently been completed at the Everett terminal to provide better facilities for handling passengers at this important transfer point. This terminal is located at the northerly end of the rapid transit line and passengers transfer here to surface cars.

The in-bound rapid transit platform has been widened from 12 feet to 20 feet. Two in-bound surface tracks have been provided in place of the single in-bound surface track, and the width of the unloading platforms has been increased from a single platform 24 feet wide to two platforms totaling 47 feet in width.

A covering 65 feet wide and 210 feet long has been erected over the unloading surface tracks and platforms.

A platform permitting 6¼-cent local riders to board and leave cars inside the entrance to the station has been provided to eliminate the hazard that formerly existed when the local-fare passengers had to leave and board cars in the street, and to cross automobile traffic.

The bridge over the rapid transit tracks has been extended over the out-bound surface tracks, which makes it unnecessary for passengers entering the station from the street at the main entrance to cross the two in-bound trolley tracks in the station.

Other Safety Features in Stations

At all high-level stations on the rapid transit lines, the space between the side of the train and the edge of the platform is maintained in so far as possible within the limits fixed by the Court, namely 3 inches. Where platforms are built on curves, sliding platforms at each car door are provided.

The stairways at all stations are provided with safety treads. Constant study and experiment has determined the safest type of tread to use and it is believed that a tread made of cast iron and carborundum, with longitudinal grooves parallel to the edge of the tread, is safer than any other type. The safety treads on stairways are maintained in such excellent condition that accidents resulting from defective treads are practically negligible.

Concrete station platforms are closely inspected to prevent the surface from wearing dangerously smooth at places where the use is greatest. At such points the surfaces are roughened with pneumatic tools.

During snowstorms, particular care is given to removing snow from rapid transit stations and stairways and to sanding the platforms and stairways. The same care is given to sidewalks adjacent to property owned by the Railway.

Improvements at North Station

The terminal station of the Boston and Maine Railroad in Boston, known as the "North Station," was recently rebuilt. In connection with this improvement, the Elevated Railway remodelled its station at this point, to facilitate the movement of steam-railroad passengers to and from the electric railway lines, several of which serve the North Station. The design provided for separation of lines of passengers going in different directions, and for ample fare collection facilities, with passimeter gates to prevent crowding.

A large auditorium on the second floor of the railroad terminal, known as the "Boston Garden," having a capacity from 18,000 to 20,000 people, required special arrangements for handling the crowd at the close of entertainments. It was necessary to make special provisions by way of fare-collecting apparatus in addition to that regularly used, together with stout fences and barricades to prevent undue crowding and accidents. Following an event at the Boston Garden, such as a wrestling match or similar event, the crowd pours out very quickly at the conclusion. As the rush into the "El" stations continues only from ten to twenty minutes, it is necessary to handle the large number of people in this short period. The arrangements are entirely adequate for this purpose.

Safety Equipment Which Safeguards Both Public and Employees

An accident hazard necessarily present on any rapid transit system is imposed by the presence of pits, due to the platform being several feet above the tracks. On the rapid transit lines all stations are equipped with three red flags, one at each end and one midway, for the use of the public or employees should it become necessary to flag a train to stop in emergency.

An enamel sign on each flag holder reads:

"Emergency flag
for use only to prevent accidents
Holding flag across track is signal for train to stop."

The safety of the public and employees on the rapid transit system depends to a large extent on the signals which control train operation. When the rapid transit lines were put into operation in 1902 they were equipped with the then best type of signal and interlocking apparatus, the system being direct-current electro-pneumatic semaphore signals, with automatic electro-pneumatic stops.

The signal system on the original rapid transit lines, with the exception of the Atlantic Avenue loop, has been entirely modernized, changing from the direct-current electro-pneumatic semaphore type to the alternating-current color light system. The stops are electro-pneumatic and the interlocking plants have been rebuilt and are now controlled by the alternating-current electro-pneumatic system.

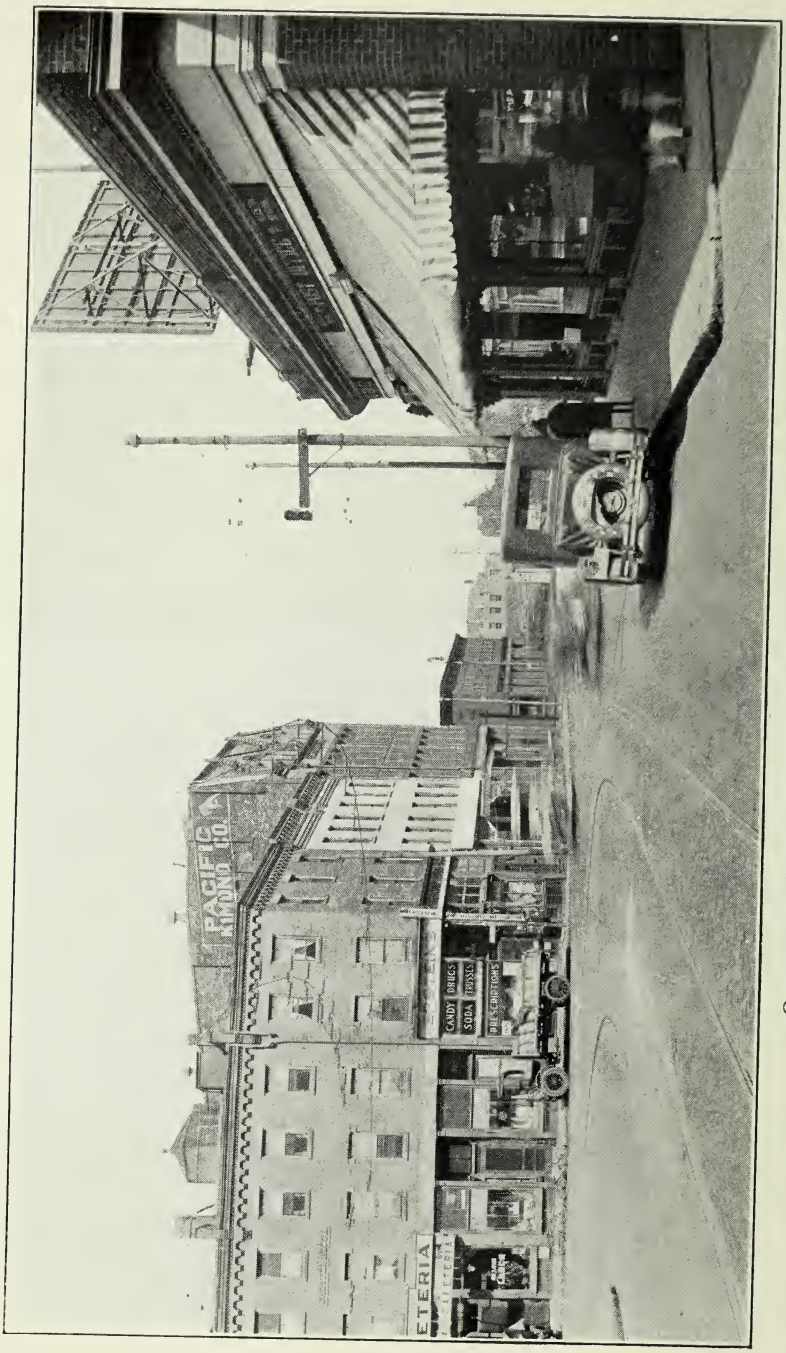
All of the recent extensions have been equipped with similar modern signal and interlocking apparatus. The signal system provides for 1½-minute headway with full block overlaps. The "aspects" of the color light signals are red, yellow and green.

Safeguards at Drawbridges and on Curves

To eliminate the possibility of a train running into the Charlestown draw when open, trains are held at City Square on the north and at North Station or Tower C on the south, and are brought to a stop at the controlling signals before the drawbridge can be opened. These trains, therefore, stand several hundred feet from the draw, and signals at "danger" with the automatic stops in the raised position are between the trains and the draw.

At the drawbridge over the Mystic River, similar arrangements are in effect. The south-bound train at Everett terminal is held with a signal against it and a derailing switch open, and the north-bound train in Sullivan Square yard with a signal against it. Both trains are at a standstill approximately 1000 feet from the draw before the draw can be opened.

At the remaining drawbridge on the East Cambridge viaduct over the Charles River, signals on either side of the draw are set at "danger" approximately 100 feet away, and bumpers between the



Overhead Signal Operated from Starter's Office

rails of the track are raised into the "up" position before the drawbridge can be opened.

The allowable speed for train operation on all curves on the rapid transit lines has been carefully computed. The information as to the allowable speeds is given to the motormen by means of a table inserted in the rule book. In addition, each curve where the allowable speed is 25 miles per hour or under is marked by signs showing the allowable speed, and by an additional sign which shows when the rear end of the train has cleared the curve.

Cutting Down Trolley Breaks

Previous to 1924 the repairs and maintenance of trolley wires were based on defects located by periodic inspections of the lines. In that year a new system was adopted based on the number of trolley-wheel "passes." The life of the materials used which are subject to wear is determined by service tests. All line material subjected to wear is renewed and adjustments are made after a certain number of trolley-wheel passes, the frequency of renewal being determined by the service on the line.

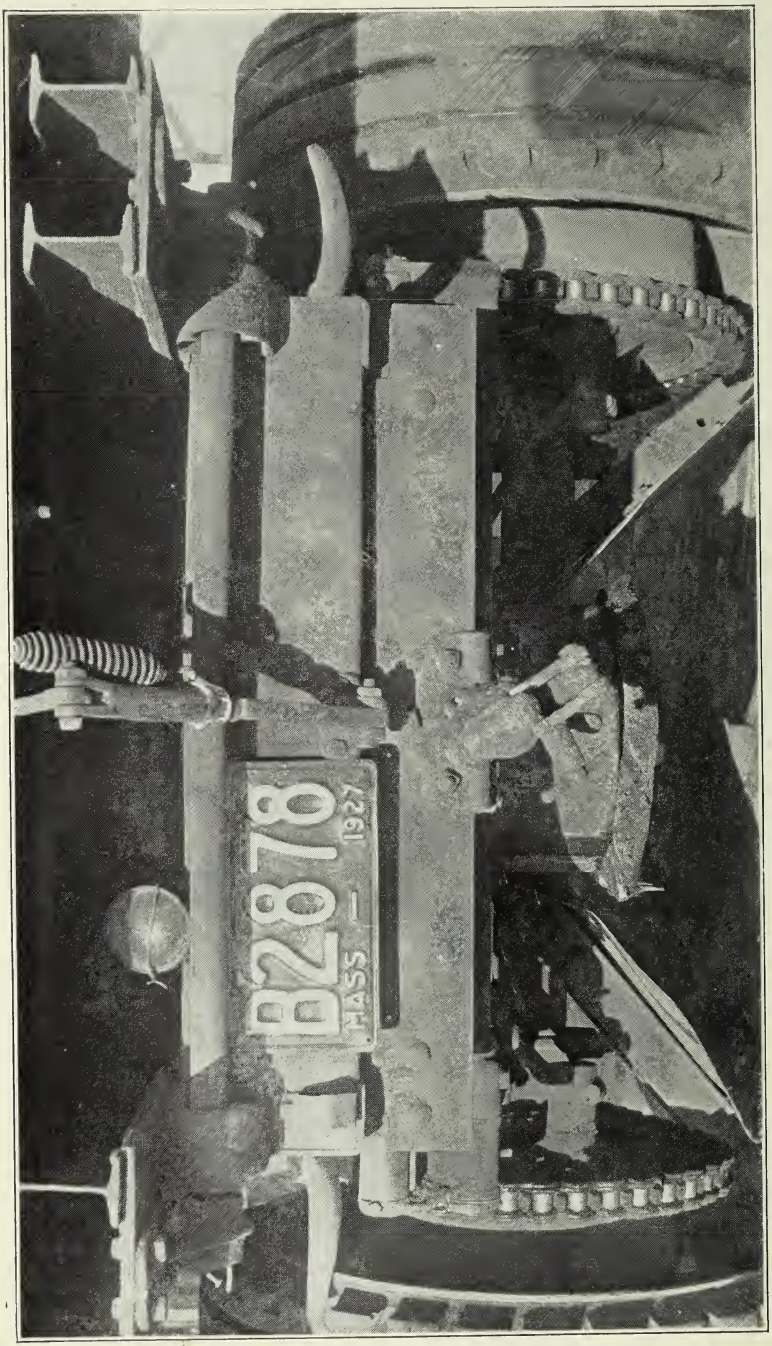
The result of the change in practice was a remarkable reduction in the number of trolley-wire breaks. To stimulate interest in further reduction an alertness contest was started among the line crews. The crews strove to make the best record for a month, and the contest was continued until it was concluded that it had produced the desired effect.

The cumulative result of all of this effort was a reduction from 331 trolley breaks in 1923, and 265 in 1924, to 144 in 1927 and the same number in 1928.

Snow Removal for the Protection of the Public

Due to the extensive use of automobiles in winter, as well as during the open months, it has become necessary for the "El" to remove the snow not only in the track area but also for a width of at least 14 feet in the adjoining roadway. This is to enable motor vehicles used in the winter to operate on the highway rather than in the track area as formerly.

In addition to plowing the snow back by means of scrapers and wings attached to construction cars, and by means of new snow plows which have been equipped for this purpose, the Railway uses



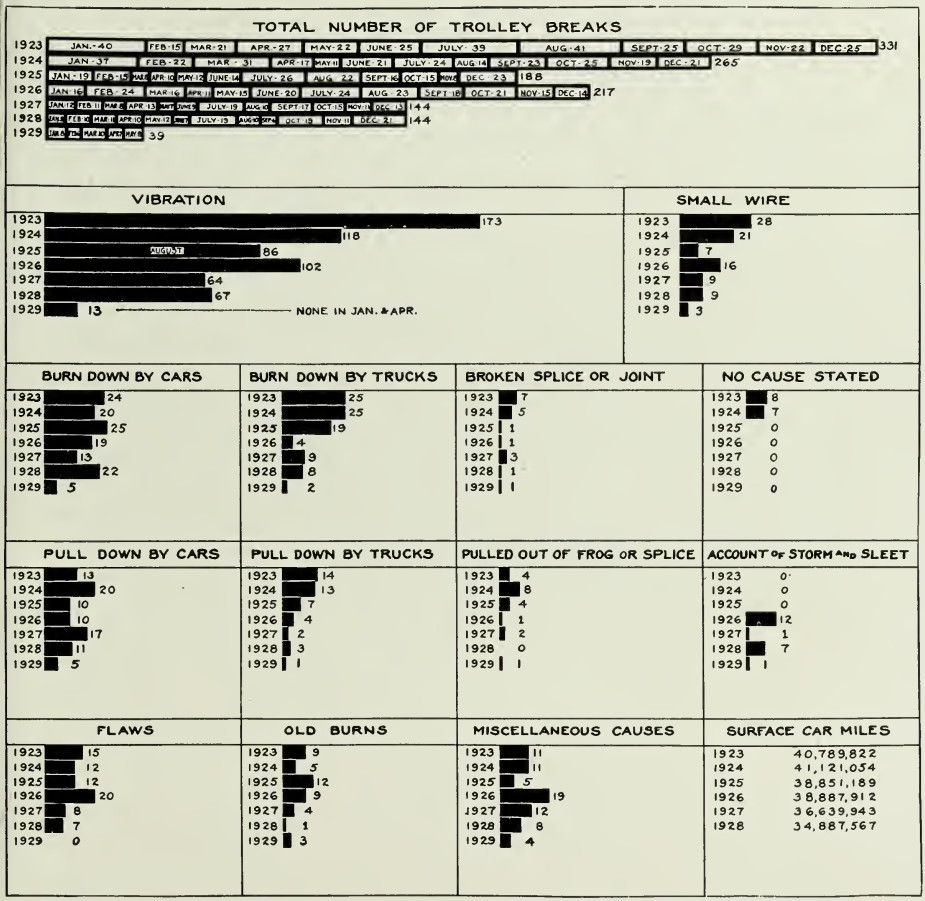
Sand Spreaders for Bus Routes

a large fleet of trucks equipped with nose plows to push the snow even further back, in many cases to the gutter.

Due to these measures the street surface is free from snow for practically the entire width during the entire winter.

During snowstorms, all activities in the Maintenance Department pertaining to the maintenance of track cease and the attention of the entire personnel is devoted to keeping the lines open and removing snow from the tracks and switches. The department cooperates to the limit with the Transportation Department during these periods.

The Railway operates 312 buses over 140 miles of highway.



GREAT IMPROVEMENT IN TROLLEY BREAKS

These routes must be kept safe for bus operation, consequently the highways over which buses operate are plowed with Railway equipment; tractors and trucks equipped with snow apparatus are used to a sufficient number to insure these results. In the climate of Boston and vicinity, where the temperature changes suddenly, sleet forms quickly on highways and causes the street surface to become dangerous for bus operation. When this condition is detected, trucks equipped with special devices for distributing sand are sent over the bus routes, spreading a coating of sand over the entire width of the street. Seven sanders are used for this purpose.

On the third-rail lines of the rapid transit system the third rail is exposed and during periods such as described above sleet forms on the third rail. Each passenger car is equipped with four steel wire brushes which are used under a considerable pressure on top of the third rail to remove the sleet. Work cars are also equipped with many brushes and are used in addition to the regular passenger equipment. Even with these precautions, ice forms on the third rail in some sections of the system and it is necessary to use other means. Scraping the ice from the third rail with tools with insulated handles is exceedingly dangerous under the conditions then existing. To reduce this hazard hydrocarbon oil is stored in locked, fireproof sheds at strategic points and the flaming oil is applied to the third rail by means of safety cans.

The wrecking equipment provided for ordinary summer use on the surface lines is not sufficient during winter months. Additional equipment, consisting of trucks manned by a crew of men, supplied with jacks, rope, tackle, shovels, picks, etc., is located at strategic points to assist in removing broken-down vehicles from the track or in close proximity thereto. This not only assures free movement of railway cars but prevents accidents.

PART III

Notable Success in Actually Reducing the Number, Seriousness and Cost of Accidents

PART III

Notable Success in Actually Reducing the Number, Seriousness and Cost of Accidents

After the Railway had spent considerable sums of money to better the operation of the system and make it safer, the next step taken was a study of the human factor in accident.

Recognizing that even with perfect equipment, accidents may be caused through some human failings, primarily of a psychological nature, the Railway engaged the services of an organization specializing in the study of industrial psychology, namely, the Personnel Research Federation of New York. The Railway took this step not because there had been any appreciable increase in the number of accidents but because the rate of reduction was less than the rate of increase in accident costs. It was necessary, accordingly, in order to check the increasing costs, to obtain a substantial reduction in the number of accidents.

Preliminary Studies

The Personnel Research Federation commenced by making a preliminary study, during the latter part of 1927, on the interrelationship of accident proneness and various other factors in operating efficiency.

The results are briefly detailed below:

Accidents do not distribute themselves impartially among the men who operate cars. One-half the accidents happened to less than a third of the operators. In one sample of two hundred men of ample experience and maturity in the service, one-half the accidents happened to only one-fifth of the motormen. This seems to show that some men are more liable than others to have accidents. This difference in proneness to accidents holds even when the question of blame is eliminated. The men with most chargeable accidents seem to be those also who have most non-chargeable accidents.

Relation of Accidents to Operating Ability

Is there any relationship between the operator's driving ability and the number of accidents he has? It was decided to take as the index of a man's ability his percentage of coasting. As one means

To All "El" Employees

ON the opposite page you will find an article by Col. W. V. Bingham, director of the Personnel Research Federation of New York, giving the substance of an address which he delivered before the transportation group conferences early this month.

The results described by Colonel Bingham show what can be done in accident reduction, in this case by co-operation applied to a well defined plan of operation.

We have been focussing attention on car operators who are abnormally prone to accidents. Such men, for convenience, are referred to as "high-accident men," classing a man thus when he has had five or more accidents in a year.

The fundamental idea underlying this work has been to show each man how he can avoid accidents. Both of the charts which are reproduced prove how successful such an effort can be. The number of men in the high-accident class has been substantially reduced, although it is true that some men who were not in this class in 1927 joined the class in 1928. The plan is to show all of these men, also, how to operate more safely.

As we look forward to 1929 may we not all work together for an even greater reduction than was secured in 1928, creditable as that reduction was?

Edward Dana

of economizing electric power, men are trained and urged to coast, that is, to let the car run without application of either power or brakes. A perfectly objective measure of their percentage of coasting time is available. Each car is equipped with a clock which automatically records for each trip the total number of minutes during which the car is running without using either power or brakes. This coasting time divided by the total trip time gives a coasting percentage. Like other criteria, coasting time is influenced by some factors other than the man's driving ability. It is an objective criterion, however, and is certainly in some measure related to the operator's skill and his ability and willingness to keep his mind strictly on the job.

The one hundred best coasters and the one hundred poorest coasters were selected and the number of accidents which they had in nine months were compared. The number of delinquencies of various sorts recorded on their service records was also tabulated.

Table 1 shows clearly that the low coasting men are more liable to have accidents than the high coasting men. It also shows that the service rendered by the men, i.e. the number of their delinquencies, is related to number of accidents and to coasting percentage.

TABLE 1

Showing that men who operate economically tend to operate and also to give more satisfactory service.

	Accidents	Delinquencies
Men with low coasting record	364	73
Men with high coasting record	313	46

Service Records in Relation to Number of Collisions

The various delinquencies of the bus operators as recorded on their discipline cards were next studied. These were classified as:

a. Misses and refusals to take set-back.
b. Driving indicating possible recklessness; too fast, failing to make safety stops, running ahead of time, etc.
c. Treatment of bus, in use of gears, clutch, etc.
d. Causing inconvenience to passengers, by jerking the bus, not pulling in to curb, not displaying proper destination signs, etc.
e. Failing to reset ticket register, etc.
f. Failing to send in proper records.
g. Overs and shorts. (Inaccuracies in fares turned in.)

Two explanations are possible. The men who are less economical of power make these coasting percentages because they are less skilled in the driving of their cars, and the number of accidents which they have is also a result of this comparative inefficiency. Or, low coasting men have higher accident records because they are more often careless and negligent in their driving.

Table 2 shows the average number of each of these delinquencies among low and high-accident men, and the percentage of these men making them.

According to Table 2, high-accident men are worse than low-accident men in their general service records. More of them tend to offend and to offend more often.

TABLE 2

Showing relation of delinquencies to accidents.

	Low-Accid. Men		*High-Accid. Men*	
	Aver. No. of delinquencies	*Percentage of men making them*	*Aver. No. of delinquencies*	*Percentage of men making them*
a. Misses and set backs	3.9	70	4.3	95
b. Not safe driving	2.3	90	3.0	95
c. Gear-grinding, etc	2.4	59	2.6	86
d. Passenger inconvenience	2.2	89	3.4	100
e. Failing to reset ticket register	1.8	55	2.5	100
f. Incomplete or inaccurate records	1.8	22	3.0	64
g. Overs and shorts	17.	95	23.	95
Average	25.8	69	38.3	91
Average without (g)	9.7	65	16.8	89

Physical Condition in Relation to Accidents

All men over fifty years of age are given an annual medical examination. Among the items measured and recorded are blood pressure, systolic and diastolic. Men whose blood pressure is strikingly abnormal are induced to seek special medical treatment or are given other work, or if necessary are pensioned. This is not uncommon in railway practice, since the management cannot afford the risk of leaving a street-car or a locomotive in charge of an operator who might be subject to a stroke, or to loss of consciousness in case of a sudden emergency. It has not been generally recognized,

however, that excessive blood pressure, even when it is not so high as to indicate danger of sudden collapse, may nevertheless be a symptom of incipient nephritis or of some systemic condition which affects general health and temperament to an extent which may seriously interfere with safe driving.

The data as to blood pressure of 59 men over fifty years of age were submitted to a medical authority who classified them as normal or abnormal. Then their accident records for the preceding year were examined.

Table 3 shows the association between number of accidents and blood pressure. It appears that men over fifty years of age with abnormal blood pressure had on the average somewhat more than twice as many accidents as did men of comparable age and experience with normal blood pressure.

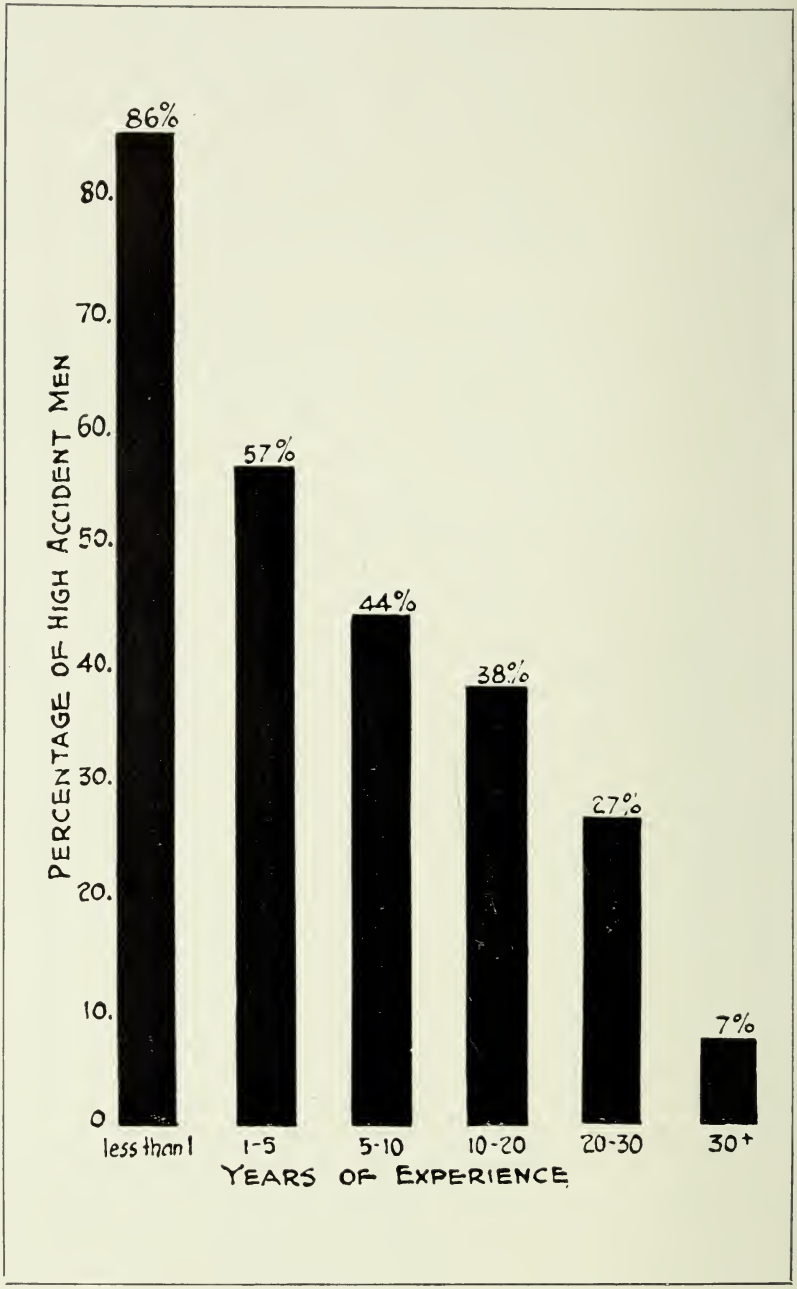
TABLE 3

Relation of blood pressure and accidents.

Men over 50	*No. of Men*	*Total No. of accid.*	*Aver. Per man*
With abnormal blood pressure	21	136	6½*
With normal blood pressure	38	110	3

*Approximate.

Blood pressure has not been related to number of delinquencies, but as the data showing the relationship between delinquencies and accidents were taken from the records of the same group of men as those used to determine the relationship between blood pressure and accidents, there would seem to be grounds for assuming that there is a relationship between blood pressure and delinquencies. An inter-relationship between these three factors, abnormality in blood pressure, number of delinquencies and accidents, would suggest that in some measure physiological condition probably accounts for both the number of delinquencies and the number of accidents. An excessive number of accidents may possibly also react on blood pressure. The relationship among these three factors is a matter requiring further investigation. The findings are recorded, however, because they so strongly suggest how misleading it would be to infer from a relationship between delinquencies and accidents that carelessness is the fundamental cause of the accidents. From a practical viewpoint, if an abnormal condition of the circulation is



RELATION OF ACCIDENTS TO EXPERIENCE

affecting a man's behavior, there is not much use in suspending him or reprimanding him for carelessness.

Length of Service in Relation to Accidents

The studies of delinquencies and blood pressure were made from the records of older men long in the service of the company. The records of the men as a whole were next studied to find the relationship between length of service and number of accidents. Car operators were divided into eight classes: those with less than one year of driving experience, with one to five years, six to ten years, eleven to fifteen years, etc. Table 4 shows the average number of collisions per man in the various classes.

There is a definite inverse relationship between length of service and number of accidents. It is to be expected that competency comes with experience. However, two additional points may be noted:

First, the selective process of time. Men who are unadjusted or who are not happy in the job leave during the course of years. A man who is having many accidents is not apt to be particularly happy.

Second, the largest number of accidents and the large proportion of men having a large number of accidents are in the first group, that is, those with less than one year of experience.

The relationship between length of service and number of collisions is probably most plainly told by Table 4. It shows the percentage of men in each class of service who are high accident men.

TABLE 4

Showing in general that with increasing experience, an operator has fewer collisions.

Years of Driving Experience	*Number of Men*	*Average Number of Collisions*
Less than 1	7	13.6
1-5	19	6.2
6-10	16	5.9
11-15	29	5.4
16-20	26	4.8
21-25	22	4.8
26-30	23	2.9
Over 30	14	2.9

These studies show that that following classes of men may be regarded as more than ordinarily prone to accident:

1. Those who do not operate economically, as shown by low-coasting records.
2. Those whose record of delinquencies is long.
3. Older men with abnormal blood pressure.
4. Younger men with very limited experience.

Accident Prone Men and Their Treatment

Late in 1927 and during the early part of 1928, car operators and motormen's records were studied individually. For the purpose of convenience they were divided into two classes:

(a) High-accident men, i.e., those with five or more collisions during 1927.

(b) Low-accident men, i.e., those with fewer than five collisions during 1927.

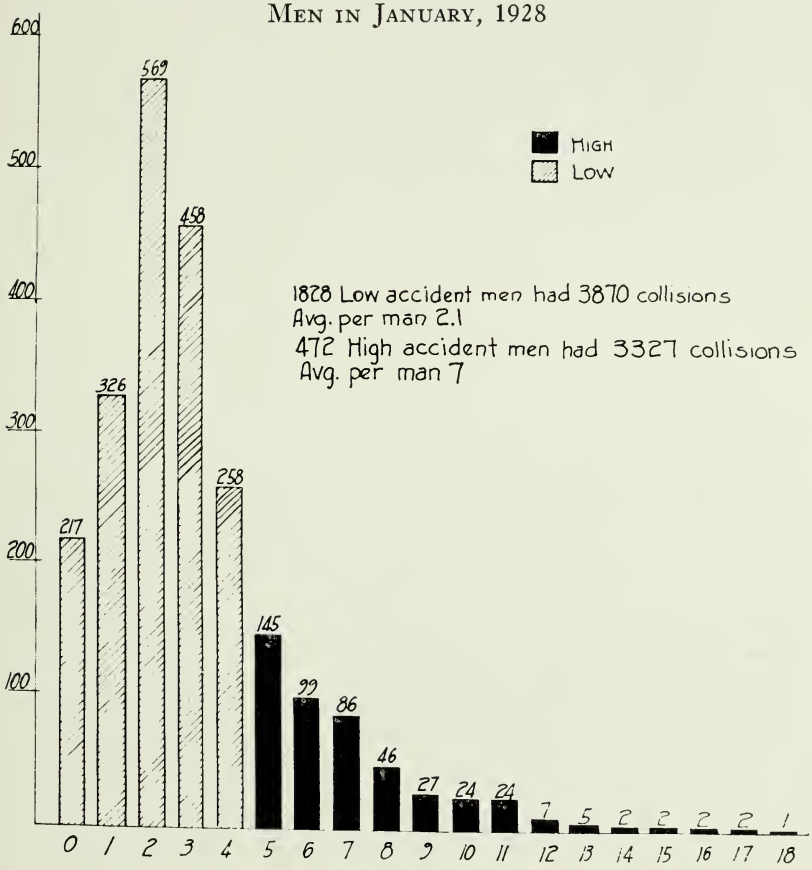
In these studies only surface-car motormen and operators of buses were considered.

It was found that, out of the 2,300 operators, approximately 20%, or 472, were high-accident men and the remaining 1,828 were low.

The 1,828 low men were regarded for the time being as satisfactory operators requiring no particular attention from the Safety Advisor. They, of course, were under the usual influences inducing safety, i.e., normal supervision, safety appeal, educational efforts, etc.

The high-accident men were then studied and handled individually. All accidents of major and minor degree were taken into account, because two things were noted about these men: (1) The man who tends to have many slight accidents, which are themselves relatively unimportant, is also the man who tends eventually to have serious accidents which may cost the Railway considerable sums of money. (2) The man who has many accidents in one year is also the man who is likely, if he is still operating on the street, to have accidents every year. Accident proneness may, therefore, be regarded as something in the nature of a disease which has to be diagnosed and treated. The first step in treating a man is finding out why he has accidents.

CHART SHOWING PROPORTION OF HIGH AND LOW ACCIDENT MEN IN JANUARY, 1928



METHOD OF STUDYING AND HANDLING HIGH-ACCIDENT MEN

The 472 operators were placed on the high-accident list because they had had five or more accidents in 1927. Instructors were then brought into conference and a list of operating habits liable to contribute to accident causation was drawn up. The instructors then rode on the cars with these operators, making observations as to their habits. These observations were made during six trips so that a reliable judgment could be formed.

At the time that the instructors were riding with the operators, their divisional records for 1926 and 1927, and their employment and individual records were prepared for reference. In the ma-

ELECTRIC TRACTION

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Salvaging Man Power

Application of Practical Psychology Reduced Accidents on Boston Elevated Railway by Twenty Per Cent

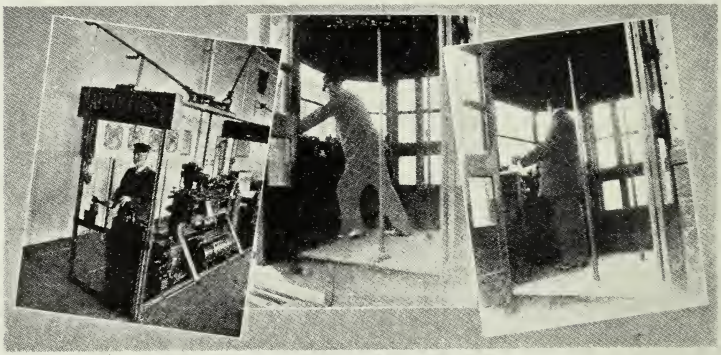
By F. N. Hollingsworth

Statistics recently compiled by the Boston Elevated Railway show that there was a reduction of 20.5 per cent in the number of accidents on the system during the first two months of this year, in comparison with the same two months in 1927. The reason for this lies in the practical application of psychology to the study of accidents and their causes and to the personality of the men who had the accidents during their operating work.

Two years ago last November officials of the Boston Elevated, after a study of the situation, conceived the idea that there might be a solution of the accident problem through an analysis by experts in psychology, who might devise means for reducing or eliminating accidents entirely. So they arranged with the Personnel Research Federation through an appeal to experts of Harvard University for a trained industrial psychologist to spend some time studying conditions to see what he could do in helping solve the problem. Dr. Charles S. Slocombe, a noted industrial psychologist, was assigned to the work, and given a free hand. To begin with he dropped the title of psychologist, which caused a certain amount of distrust at first among employes and chose to call himself a safety adviser, and as such he is now on the rolls of the company, as Safety Adviser to the General Manager.

Study Men On the Cars

Some months were spent in a general survey by Dr. Slocombe, which proved that a certain percentage of the operators were prone to have more accidents than the majority, and also that these opera



Training School of Boston Elevated Railway. Left—Complete Working Model of the Operating Part of Car. Center—Motorman in Bad Operating Position, in Case of an Impending Collision He Is Not So Placed to Act Quickly, such as Shutting Off Power, Applying Brakes and Throwing Overhead Switch. Right—Easy Natural Position with Freedom to Act In Any Emergency

(Table of Contents on Page 320)

Typical Page From Technical Magazine Describing Accident Reduction on the "El"

jority of cases the Safety Advisor and Supervisor interviewed the operators to gauge their personality for the purpose of future conferences with instructors.

As soon as observation of an operator was completed, the instructor concerned conferred with the Safety Advisor, the Safety Supervisor, and the operator. The habits of the operator, his record, personality, and medical condition were all considered together in an attempt to arrive at conclusions regarding the cause of his accidents.

Classification of High Accident Operators

Occasional lapses into poor operation	20%
Moderately poor operating habits	21%
Poor operating habits in extreme	9%
Capable but irresponsible, requiring constant supervision	7%
Fast with disregard for traffic, too aggressive	5%
Requiring complete reinstruction	3%
Operates both bus and car. Should be one or the other	3%
Medical or visual limitation	10%
Temperamental peculiarities	6%
Requiring transfer to other work	7%
Pensioned	3%
Discharged	1%
Total	100%

Occasionally the cause was obvious, but more often several explanations were possible. When this was so, the probable causes were taken in order of importance and in relation to the possibility of individual action being effective.

The principle which guided the determinations of this committee was that its conclusion should be in such form as to lead to action. It would have been easy to make up interesting tabulations showing contributory factors, in fact such were made later —but the main thought was, "This man has to be (if it is at all within the bounds of human endeavor) cured of his accident tendencies." This dictum, although it narrowed considerably the nature of the conclusions, made them, nevertheless, more valuable.

The above is a typical tabulation of 100 men and the reasons for their accident proneness. It is obvious, of course, that more

than one cause might contribute to many individual accidents, but when this was so the most probable was tried first.

The method chiefly depended upon to produce a reduction in accidents was instruction on the job by the especially trained instructors. They were carefully selected. Great care was taken that the right instructor should handle the individual man.

All this trouble may seem to have been unnecessarily elaborate —that it merely resulted in instruction and that the purpose could have been effected simply by asking the Instruction Department to re-train all high-accident men. Two things, however, should be pointed out:

(a) That the same instructors had been on the job instructing these men for years. As very few new men were being hired the instructors had nothing else to do but observe the operation and instruct men accordingly.

(b) That the policy of the Railway was and is not to dismiss a man except for such grave offences as criminal negligence, drunkenness on the job, fare irregularities, etc. It was up to the Safety Advisor, therefore, to advise a means by which operators, no matter how hopeless they appeared to be, could be brought up to the normal standard of safe operation. Constant instruction of a very specific and definite kind determined after a thorough study of the man was the method decided upon. Other methods might have been possible but the soundness of this was justified in the results.

IN 1928
COLLISION
ACCIDENTS
ON THE
BOSTON ELEVATED
RAILWAY
DECREASED
18.6%

While instruction was mainly relied on, other available methods were, of course, used when they seemed better. Two other methods were used:

(a) Interview by the Safety Supervisor and Division Superintendent where the accident record of a man indicated that he did not realize his responsibilities regarding other people's rights on the highway, the safe transportation of passengers, etc.

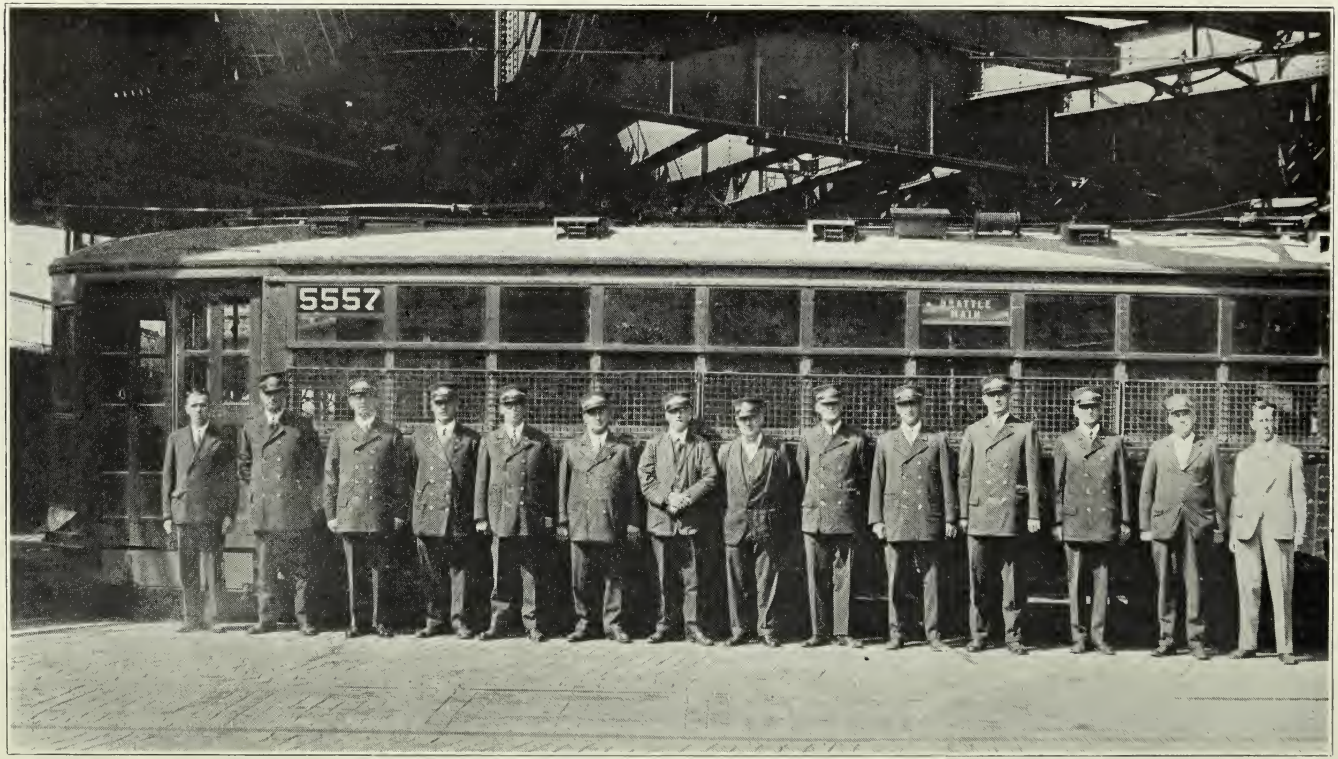
(b) Where the cause of accidents was ill health, the men were medically examined, told what was the matter with them and advised to go to their own physicians for treatment. A check was made to see that they did this. This method was very carefully developed and the men appreciated the attitude of the Railway in examining them not for the purpose of finding something the matter with them in order to lay them off, but in order that minor troubles might be dealt with promptly so that the men might be better able to continue in good health.

Follow Up

Each operator to be instructed was given four hours' instruction, the instructor reporting his opinion of the results of his instruction. In view of the fact that the habits to be changed were generally of long standing, and would require some time to change and crystallize in their changed condition, it was necessary to arrange follow-up work. Each instructor was required, therefore, to see each of his operators on the job every three days, week, two weeks, or whatever period seemed necessary, according to the seriousness of the case.

This method worked for some time until it became apparent that although a man might do his job well during the hour the instructor was with him, he might not do it at all well during the other 47 hours of the week.

It became necessary, therefore, to enlist the employment of the entire street supervisory force. Their hours and duties were rearranged and set out to include a great measure of personal supervision of high-accident operators. Conferences and meetings were held in which the members of the supervisory force were acquainted with the objects in view, the nature of the assistance and the great care and study that they must use in this co-operation. The observation and oversight of a selected number of operators is always likely to be misinterpreted as discrimination and victimization if not very carefully handled. So far as is known no operator has ever had cause to appeal to the General Manager on these grounds—a direct tribute to the understanding of the supervisory force and to the excellence of the employees as a whole.



J. L. Troy
Supvr. Safe Operation

SAFETY INSPECTORS

Dr. C. S Slocombe
Safety Advisor

Safety Inspectors

A selected group of instructors and supervisors were consolidated into a group of Safety Inspectors working directly under the Safety Supervisor.

To explain in detail the duties and responsibilities of these men would require much greater space than is available. Brief outline only may be made of some points:

1. Districts were allotted to the safety inspectors according to the routes and districts where the accident hazards were greatest. Very careful studies of accidents were made in order to determine the locations and boundaries of safety inspector districts. Not only location, but also type of accident, time of accident, etc., were studied for this purpose.

2. The inspector assigned to each district was required to go over his district carefully, to know all the dangerous spots and the peculiarities of traffic, and to determine the special types of operation required in these places.

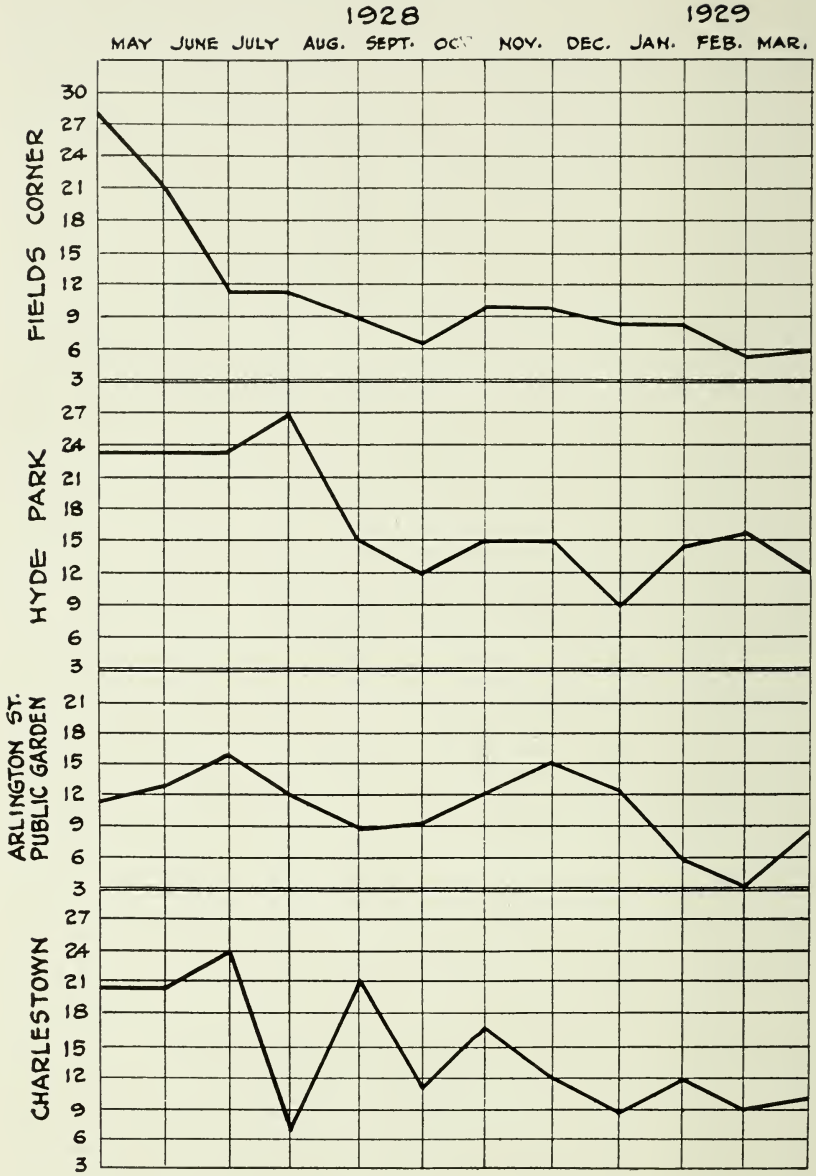
3. The inspector was also given a list of high-accident men who were operating, or who would be likely to operate, through his district, and all necessary details as to peculiarities of character, habits, etc., of these men.

4. These high-accident men were then to be regarded as the inspector's special care so that he might make available for them all the information he had regarding the district as to accident hazards, and he was required to see that their operation was proper in all respects.

5. With the changes in schedule which take place in the fall, winter, spring and summer, many operators change their routes. At these times the safety inspectors are given lists of all new operators coming into their territory and are expected to explain to these men the peculiarities of the section or district.

6. The entire system could not be covered by safety inspectors. It was hoped, however, that the influence exerted over the operators while an inspector passed through his district might carry over to territory outside. This hope has been realized.

7. The safety inspectors do not replace the regular street supervisors but are in addition to them. They work in close cooperation with these supervisors and meet them daily. In this way the inspectors are expected to contribute to the training of regular street supervisors and to maintain the supervisors' interest in safety.



Accidents Per Month by Districts

8. A record sheet is kept of each district as a check on the effectiveness of the safety inspectors, and also to give them a measure of their own results. This was found to stimulate their interest considerably. They are very anxious to keep their districts on a basis of decreasing accidents and, if possible, to achieve a clean accident record.

9. The safety inspectors are regarded as highly trained specialists in safety who are in close touch with operation all the time. They are, therefore, expected to make suggestions and recommendations regarding improvements in equipment and operating practices conducive to safety. Their opinion is consulted as to the suitability of any suggestions made by other persons in the operating department.

Other activities of the Transportation Department concerning accidents have been as follows:

1. Division superintendents have been called into the office of the general superintendent for consultation regarding the method of handling men. If there was any difficulty found by any of the superintendents in improving the accident records of high-accident men, the cases were discussed with them and other methods of treatment suggested which might be more effective. The superintendents have made a study of each individual case to disclose peculiarities or idiosyncrasies, so that the proper treatment might be given in each case.

2. The dispatchers and car-house starters have contributed, although they have no supervision of operation on the street. They have done their share on occasions when weather conditions were unfavorable, such as wet nights when leaves were falling on the rail, or when any other condition arose to make operating difficult and dangerous. They would warn operators when they swung on to their cars. Thus, if a man operated on a route new to him and with hazardous points in it, the starter would tell him about it, and not limit himself to advice on safety.

3. A careful check has been kept by these car-house starters and dispatchers as to the punctuality with which cars leave and return to the car house. Thus, any unusual delays are checked up to determine whether the operator is slow and lacking confidence, or is too fast. They thus check him as to his habits of dangerous operation.

4. These starters have also been encouraged thoroughly to inspect cars to see that all the necessary equipment is on hand and the cars running in perfect order; to co-operate with the department of rolling stock and shops to insure that there are sand levers, sand boxes, door handles, sufficient air pressure, etc.

5. Starters and other officials stationed at heavy loading points have also checked up difficulties with equipment reported to them, have done their share in warning operators and have helped the passengers to board or alight quickly and safely.

All men throughout the system, particularly those in supervisory positions, have been asked for suggestions and kept on the "qui vive" to devise improved means for increasing safety of passengers in the matter of loading platforms, street difficulties, rerouting of cars and buses, etc.

Results Prove Soundness of Methods

During the year 1928 collision accidents involving surface cars (i. e., collisions with motor vehicles, other vehicles, cars and pedestrians) were reduced from 7,197 to 5,923. This reduction came about by concentration on efforts of high accident men. Figures comparing the records of high and low accident men for 1927 and 1928 follow:

472 High Accident Men—	
During 1927, averaged 7.1 accidents per man,--total	3,327
During 1928, 312 averaged 2.1 per man	663
160 averaged 7.1 per man	1,136
Total	1,799
1828 Low Accident Men—	
During 1927, averaged 2.1 accidents per man,—total	3,870
During 1928, 1,693 averaged 2 per man	3,386
135 averaged 5.8 per man	738
Total	4,124

From these figures it will be seen that there was a 46 per cent reduction in the accidents of the men in the first group. On the

other hand, a number of the men in the second group had a larger number of accidents in 1928 than in 1927.

The finding, after the first year's investigation, that a few of the men placed within the low accident group could not be classed as constantly low accident men, was an unforeseen but valuable result of the investigation. In this group it was found that there were certain individuals on the border line who might for a period have a small number of accidents, but who would for a subsequent period have a sufficient number of accidents to place them in the high accident group. At the outset of the investigation, it was not anticipated that there might be a third group consisting of those wavering between the low and high accident group. For that reason, at the beginning no particular provision was made for special treatment of this third group. Since the completion of the first year's work and with this additional knowledge of the existence of this third group, the system has been rounded out to include provisions for special treatment for this new group.

Accident Location Studies

Accident location studies are exceedingly useful, if not absolutely essential, in intelligent safety work. If it is assumed that the majority of trainmen desire to operate safely, then it is up to the management to give them as much real help as possible. A motorman may be assumed to be familiar with the bad spots on his line and in what way they are bad, and the inspectors and instructors to know about them in a general way. But a check-up will show that many of them have little exact knowledge, possibly because they change their routes frequently. All men can improve their operation when given exact knowledge.

Two examples are illustrative: In one case, on a particular route, a check-up showed that the inbound collisions were nearly all with the front left corner of the car; while the outbound collisions were with the right front corner. The reasons for this were investigated, and the instructors and men were told how they should operate in view of the special kind of vehicular movement existing there. This resulted in cutting the accidents on this line to one-third of the former number.

In another case, instructors were overheard telling the men how much extra care was necessary at a certain corner where serious accidents occurred frequently. Study showed that there had been

no accident there for more than a year and that ordinary caution was sufficient at this point.

To aid in the accident-location studies, a map is spotted with colored pins representing various kinds of collisions. This shows a preliminary study, indicating the locations to be studied in detail. For comparison, three or four-month periods that correspond are best. Thus, in the accident-reduction work for the winter of 1928-29, the accidents were spotted for the winter months of the previous year, not those of the fall of 1928.

After the main map has been made, the particularly black spots are given special attention and studied in detail. Then after taking into account any street or track alterations, changes in traffic lights, etc., plans can be made to prevent these spots from being black during the next period.

The times of the accidents as well as the locations are taken into account. For example, in one location which was studied, inspectors had been on duty 16 hours a day during the previous winter to look after traffic conditions, but during the evening rush the inspector was required to go to a crossover 1,000 feet away. Study revealed that 80 per cent of the accidents at this point occurred during the evening rush hour. So a man was placed there from 4 to 6 p. m. to inform operators what to expect in movement of persons and vehicles, and to help in directing their movement. This resulted in cleaning up this bad spot, and the 16 hours of unnecessary supervision was transferred to another spot where extra vigilance was needed.

In another section accidents were increasing, but the division superintendent felt that in the winter he could not possibly afford the 20 hours of supervision necessary to keep them down. The prevailing type of accident had been studied for the summer and it was known that 20 hours' supervision was needed then. A study of winter conditions showed that 75 per cent of the accidents occurred during only five hours of the day. The superintendent found that he could arrange for five hours' supervisions and did so, reducing accidents on the route from nineteen to nine a month.

These location studies are made continuously, for conditions are continually changing because of new arteries opening up, more automobiles, new stores causing extra parking, etc. But just as the transportation department must study these changes so that service may be adjusted to riding, so the safety department must continu-

ally study them to help operators keep up to date in their exact knowledge of the conditions they have to meet.

The majority of the operators use all the knowledge they possess in operating safely. The safety department makes all the studies it can, so as to give operators, supervisors and instructors the increase in knowledge which will make the difference between an ordinary and an excellent safety record.

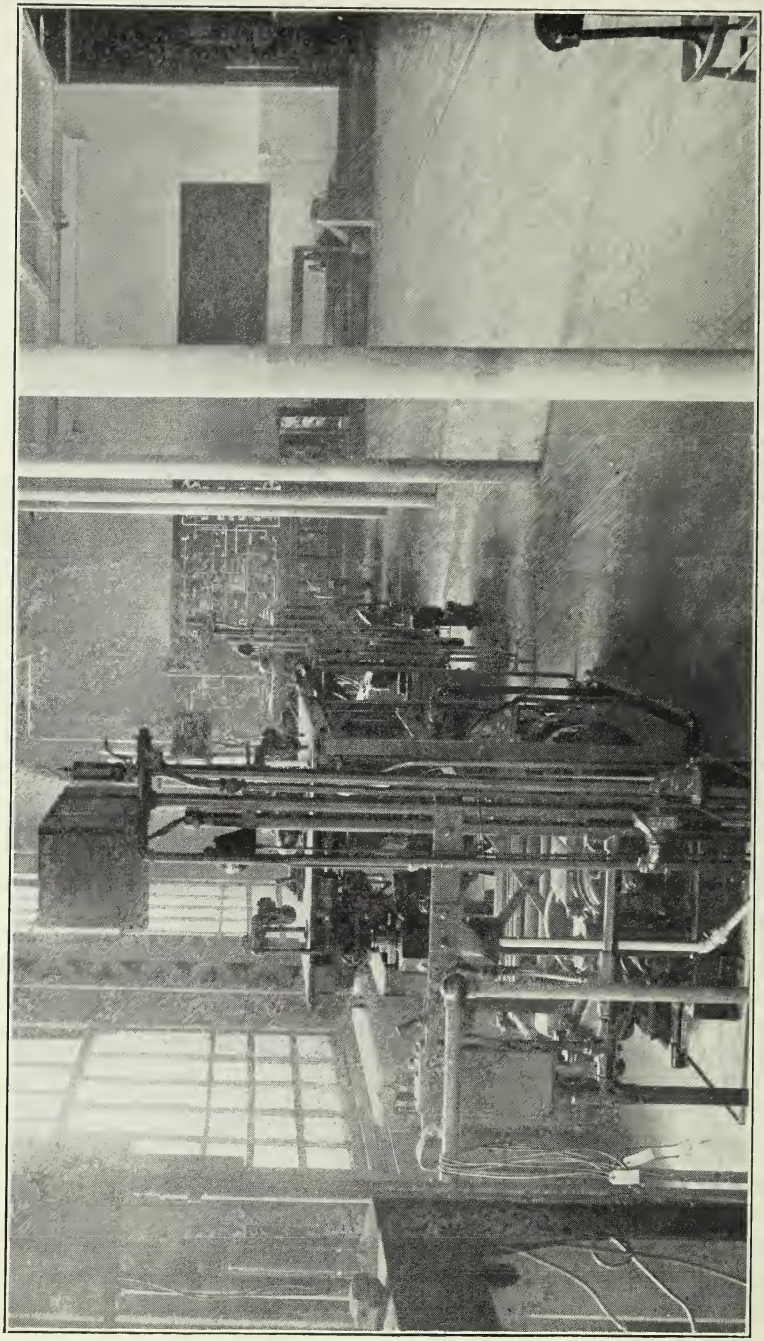
Activities of Employment, Training and Medical Departments

On January 7, 1928, the instruction school and employment office of the Railway were consolidated as the division of employment and training. This enables these two divisions of the transportation department to become more closely affiliated in connection with the employment and training of new men, and in following of their education and training.

Equipment of School

The school is equipped with demonstration installations of the several equipments and braking systems in use by the Railway. Here all employees, as well as new men, can see the equipment as it operates on cars and trains in passenger service. This equipment consists of the following:

1. Regenerative-braking demonstration-board unit.
2. No. 1 elevated car unit, with General Electric Type-M control and Westinghouse Type AMME brake equipment.
3. No. 8 elevated car unit, with Westinghouse ALFM control and Westinghouse Type-ALME brake equipment.
4. Type 2 semi-convertible car unit, with General Electric Type-M control and Westinghouse Type-AMM brake equipment.
5. Type 5 semi-convertible car unit, with General Electric Type-K71A control and Westinghouse Type-SM-3 brake equipment.
6. Types 4, 4A and 4A3 semi-convertible car unit, with Westinghouse Type-HL control and Westinghouse Type-SME brake equipment.
7. Nos. 1, 1A and 1B center-entrance car unit, with General Electric Type-PC-5 control and Westinghouse Type-SMEE brake equipment.



Instruction School Equipment

8. Nos. 1, 1A and 1B center-entrance car unit, with Westinghouse Type-SMEE brake equipment.
9. Birney safety-car unit, with General Electric Type-K63 control.
10. Mack bus chassis, fully equipped for operation.

Force of Instructors

One instructor is assigned to each of the five operating divisions, and three bus instructors take care of the instruction of bus operators in the four surface divisions. One instructor is assigned to the office of employment and training. These men are all under the supervision of the superintendent of employment and training. All instruction of new men and all reinstruction of employees already in the service is taken care of by this force of instructors.

Special Track and Yards for Instruction

A spare track is used in each division for the instruction and examination of all new men, and also for men who are to be "broken in" on other types of equipment or to be reinstructed.

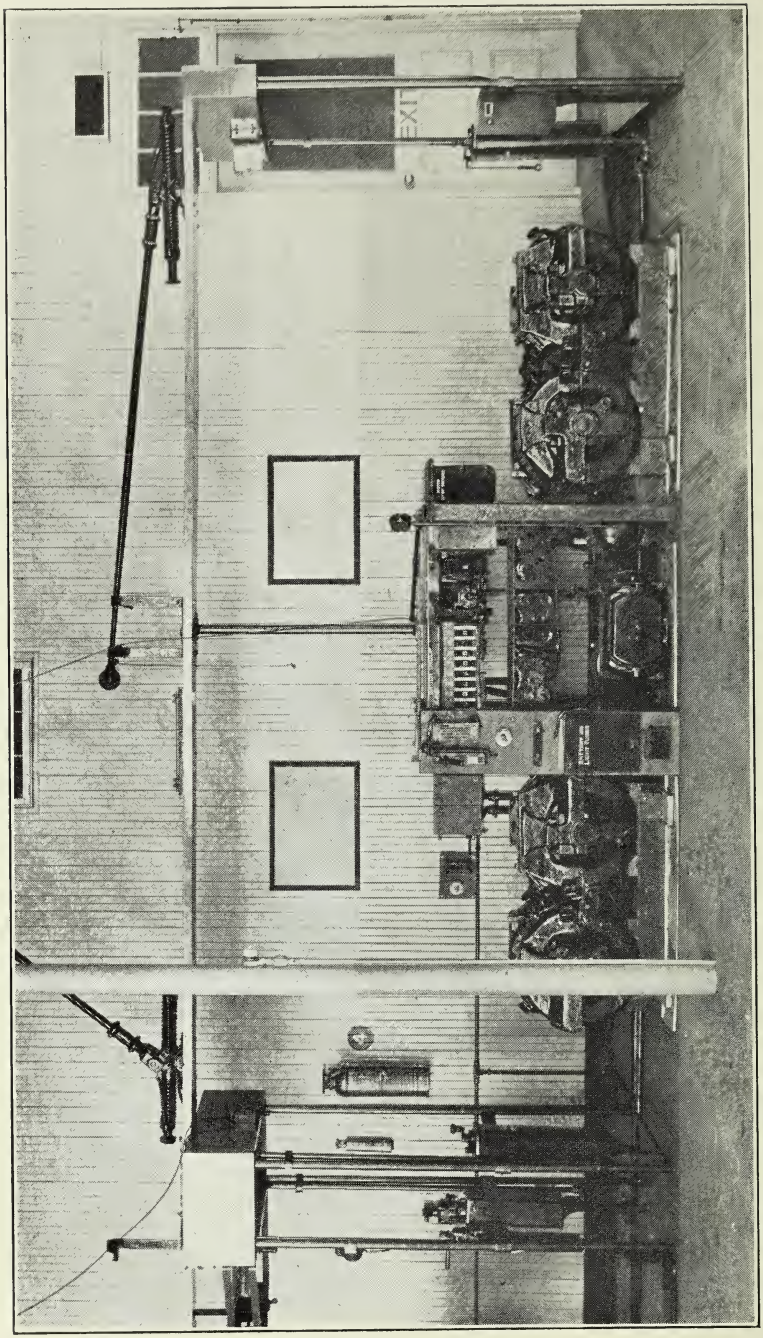
Also at the garages, an S-curve and loop are set up, with markers for the instruction of bus drivers.

An instruction yard for cars and buses is proposed for installation at Forest Hills, with a track on a grade and with a curve. This rail can be greased for the purpose of giving men thorough instructions regarding the conditions they must meet in actual car operation. In the bus yard the surface is to be paved and greased so as to duplicate actual street conditions.

This division of employment and training has co-operated with the division superintendents by placing its own regular instructors at the disposal of the superintendents. If after an interview with a man, the superintendent decides that it would be better to have this man's instruction followed up on the car, the regular instructor rides with him, and gives him instruction when necessary.

Reinstruction of High Accident Men

Eighty high accident men have been taken out on special cars in street operation by the division instructors. These men have been reinstructed from one to three days and special attention has been given to any faults in operation or habits which increase the accident hazard.



Instruction School Equipment

During the past one and one-half years all instructors have ridden with the high accident men from time to time to observe and check up on their operation.

All men transferring from one station to another, or picking work in which they will operate a different type of car from the one they have been operating, have been reinstructed in the changed conditions and on the new type of car before they start on the new work.

Jacking Cars

All men are reinstructed once a year in the use of jacks for lifting cars.

Physical Examination

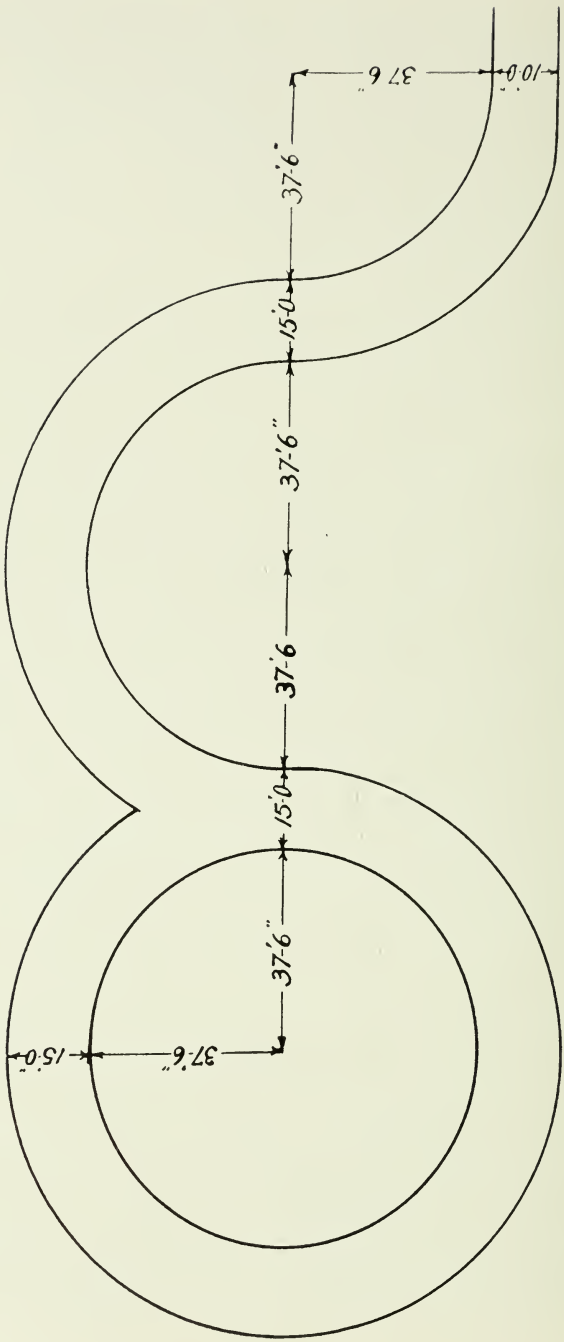
As explained elsewhere, all car and train men 40 years of age and over are physically examined annually. Those referred to physicians for treatment are re-examined at intervals of three or six months. All men off sick for any period are re-examined before returning to work.

Men found with eyesight below standard requirements are sent to their oculists for attention. If defects cannot be corrected the men are referred to the Railway's eyesight specialist for examination and report. Similarly, men found with defective hearing are sent to their ear specialist.

In 1924, yearly examination of car and train service employees 50 years of age and over was begun. They consisted of about 1,000 men.

In 1928 the age for this examination was reduced to 40 years. The group between the ages of 40 and 50 years comprises about 1,200 men. Statistics of defects found in the two groups are given below:

		Per cent
High blood pressure	50 year group	15
	40 " "	7
Heart cases	50 " "	9
	40 " "	3½
Albumin in Urine	50 " "	4
	40 " "	2
Sugar in Urine	50 " "	2
	40 " "	1½



PRACTICE TRACK FOR BUS OPERATORS

Hernia	50	Year	Growth	17
	40	"	"	6
Bad teeth	50	"	"	18
	40	"	"	14
Man referred to doctor or dentist	50	"	"	26
	40	"	"	16

Pathological conditions found in the younger group, as would be expected, are one-third to one-half as common as in the older men, except in regard to teeth.

It is necessary to remove a few men from car or train service work occasionally as recommended by the examining physician or eyesight specialist. Some of these men are able to return to their former work after rest and treatment, but some are removed permanently, given other work or pensioned.

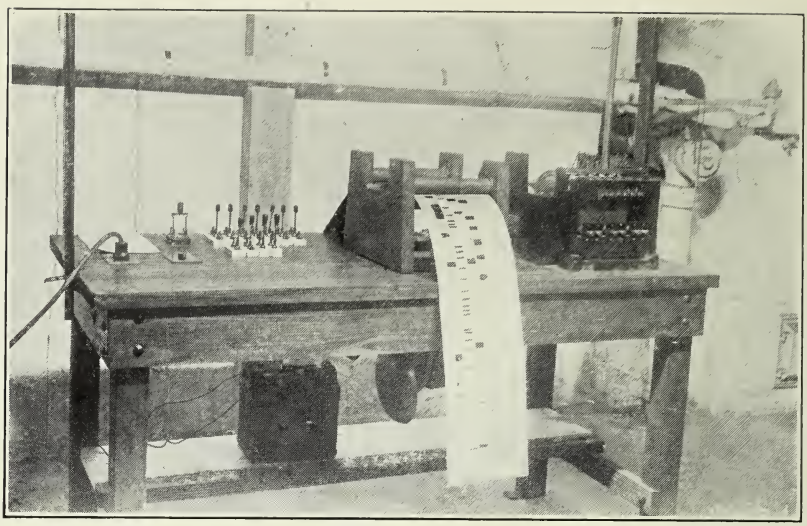
Reinstruction of Officials

Recently there has been completed the reinstruction of all starters and inspectors on all types of equipment. While all these officials are "broken in" on all types of cars in their divisions, many of them, due to the nature of their work, seldom have occasion actually to operate a car in the street. Thus details of car equipment may be overlooked. All of the men felt that reinstruction has been of great assistance to them in their work. It is proposed to continue this reinstruction as an annual feature for this group of men.

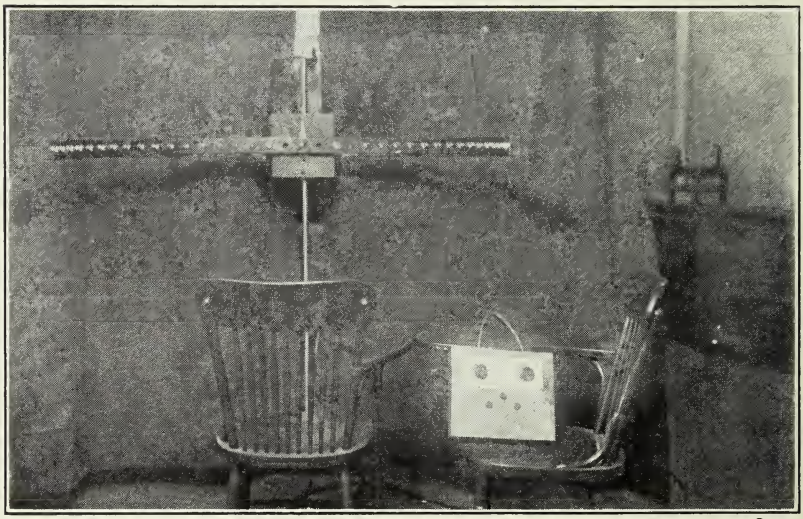
Psychological Tests

The work of 1928 showed that when every possible expedient had been tried to cure men of their accident proneness there still remained a considerable number of operators who were not successfully handled. It was suspected that there were reasons for their accident proneness that had not been discovered. Additional methods were required to determine whether there was anything in their method of reaction, distribution of attention, etc., which might be causing their accidents.

A psychology laboratory was therefore set up. After preliminary studies during the latter part of 1928, men were put through tests in the laboratory to secure further information about their mental make-up. This is a new departure in street-railway procedure in handling men already in service.



Electric Impulse Recording Machine



Peripheral Vision Apparatus and Control Board with Degree Dials Alongside

Because the management has convinced the men that the tests are not to be used as a basis for dismissal, but rather to make them better operators, the men have consented to undergo this experience of a psychological test without fear or embarrassment.

Description of Tests

Certain Factors Found to Be Constant

After observation, it was suspected by the investigators that certain factors in individuals are more or less constant as contributing causes in accidents. These psychological factors are: First, the degree of adaptability of the operator to various types of equipment; second, his quickness of reaction to sound and light; third, powers of concentration over a period; and fourth, judgment of speed and distance. And so the tests are based on the above factors.

Automatic Machines Used for Tests and Records

One—To test adaptability, the individual operates three controllers, one after another, each having a different degree of resistance. The controller and brake handle are fitted on a platform like the front end of a car.

As lights flash on and off, controlled by perforations, the operator moves his controller and brake handles in response, just as he would do under similar actual conditions. The motor-driven machine back of the screen automatically records on a roll of white paper, by pencil dots and dashes, first the impulses or stimuli and then the reaction, in parallel columns, the space between the two indicating the time of reaction to the impulse.

Two—In a light and sound test a second machine is used, also operated from behind the screen in a manner similar to that of the controller test, with the perforated roll. The operator pushes down keys similar to that in a telegraph set, first one with the right hand, then one with the left hand. After this he presses with first one hand and then the other, according to instructions as to which hand to use for the different lights flashed on.

Three—There is also a test which combines both light and sound reactions. Under street conditions an operator may need to use hands and feet simultaneously. Thus, in the test, acting under various stimuli, he sounds his gong, shuts off power and applies brakes, all within a specified time. Then there is another brief test,

reactions to which are also automatically recorded, in which he is required to sound his gong, immediately a certain light is flashed on. It has been proved over and over again that the average subject reacts more quickly to sound than to light, and that foot reaction is quicker than hand reaction. Operators react to light within 1/5 second and to sound within 1/8 second.

Four—The operator's powers of concentration are tested by subjecting him to distracting influences like those of a busy street. Lights similar to automobile headlights, gongs, horns, buzzers, flashing lights coming up from below and other noises are reproduced while the operator's reactions are automatically recorded. The gage of his efficiency is the time elapsing between the occurrence of this distraction and the proper or improper act on his part.

Five—Another machine tests for peripheral vision. It consists of a bar of wood, painted dead black and bent in a semi-circle. The operator sits within the semi-circle, eyes fixed on the center, giving him ninety degrees range at either side. A row of tiny electric bulbs fastened to the inside of the frame flash first one and then another, first on one side and then on the other, and sometimes one on each side, at different angles. The subject calls out whether he sees one or two lights, and a record is kept of the angle at which the light farthest around was seen on either side. The assistant has a wooden control with two push buttons and a degree indicator for each. When she sets the indicator for a given angle and presses the button, a light shows in the row at that particular angle. She can operate one or both indicators at a time. For example, a subject under test might be found to have a peripheral vision of 85 degrees on one side and 80 degrees on the other. Ninety degrees on each side would be one hundred per cent. The peripheral vision machine is first set at horizontal for a test, then swung toward the vertical on the right and then on the left, to test up and down vision.

Six—A comparatively simple test is the tap test. Here the operator under observation sits relaxed in a chair, and starts to tap with a pencil on the arm of the chair. This is a test more of rhythm and furnishes a means for ascertaining the nervous state of a subject. Variations have been found of from eight taps to sixty taps per half-minute. In general, the operator with fairly even, rather slow reactions, is a better and safer operator than the one whose reactions are rapid but erratic.

So far as the tests have been conducted with this new appara-

tus some subjects have been found to be constant in reaction. Others oscillate and are quite variable under different conditions and under different tests. The equipment records to 1/25 second an operator's reactions to the stimuli that influence his physical performance.

Typical Results

The following is a sample record of one pair of men who were studied and tested, showing the nature of the results of the testing:

Data Record

No. X Name A Record for 23 yrs. examined

Age 54 Yrs. of Service 27 Ht. 5-10 Wt. 184 B. P. 155/58

Vision—Acuity 20/25 Color O.K. Glasses, Yes

Physician's notes:

Personal Data: Born in Ireland—Great talker. In good health
Previous Occup. elevatorman. Breaks in Employ No

Yearly Earnings:

1924 $2354 1925 $2357 1926 $2833 1927 $2610 1928 $2658 1929 —

Sick ratio 8 1.8 Misses 5 Leaves Setbacks refused 1

Delinquencies:			
Over & Shorts	60	Fare Irreg.	
Day Card		Signs	
Minor	25	Other	

Personal Habits:

Operating Habits

Minor				*Major*		
Late	18	Poor oper.		Ahead, fast	14	3
Jerky		Talking		Derailment	5	
Safety Stop	9	hands off	5	Passing red		
Gong	4	Spec. work	2	light	5	
Door car in motion	4			Too close	5	

Insubordination and complaints 4

Former Diagnosis

Further Information—Instructed on clearance on right hand traffic

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Summary of Data

He is in good health and has an exceedingly low sick record, having been out only 14 days since 1921, when the sick record begins. Has but five misses and one setback. His attitude seems good though there are four complaints, but no case of insubordination. He is a great overtime man making over $2,600 in both 1927 and 1928 and over $2,800 in 1926. However, this is not so much as the low-accident member of the pair, No. ——. Has 60 shorts and overs but this is but half the number of No. ——. As for operating habits, late and ahead are not great and are about equal in number. Fifteen of the eighteen lates occurred in 1928 alone, while only three of the fourteen aheads have occurred since 1910.

Summary of Accidents and Diagnosis from Data

This man has a large number of accidents, 39% of them being with vehicles in same direction on right. His routes have not been among the busiest. In 1928 he ran No. —— from 6 to 12 noon and 3 to 4 A. M., having five accidents, being exonerated from all but one. In 1927 and 1926 he worked on several different routes each day. There were six accidents in each of these years, the majority of them drawing reprimands. A peculiar situation is found in 1927, where he had four accidents between Dec. 8 and Dec. 16. Three of the accidents during that year occured shortly after the rush hour (A. M.), all on No. ——. However, as no explanation of this can be found from the data it will be gone into more deeply in Diagnosis from Tests. In fact as the data record is quite good, it offers no clue for explanation of his high accident record. Of course, since he does put in considerable overtime he

NOT A SINGLE FATALITY

IN

6,533,615 BUS MILES

OF OPERATION
ON THE

BOSTON ELEVATED RAILWAY

IN 1928

has more time to have accidents than the ordinary man. However, this could not explain more than a small part of the accidents which he had.

Diagnosis from Tests

Test record reveals subject to be a person of variable attention. Reaction time is slow in the simple reaction tests and fast in the choice.

Very clearly he is a perseverator on all four tests. It is possible that this may explain some of his accidents. Examinations of his 1927 record in detail shows the following:

From June 13 to the end of that year he ran routes ——, ——, ——, ——, from 7 to 11 A. M., then route —— from 2 to 5 P. M. His A. M. routes were the same from April 11 on. The —— was run first during the rush hour, carrying a trailer, then at 9 A. M. or thereabouts the man switched to —— and a one-man car. It may be significant that three accidents occurred on the latter route all shortly after the change had been made (total number of accidents that year was six). The first occurred May 11 and was with an auto going the same direction on the right. The second, Sept. 13 at 9:33 A. M., accident not described. The third, Dec. 16 at 9:20 A. M., with a truck going in the opposite direction on the left. As car passed the truck turned and hit car. Then there is no apparent similarity in the accidents themselves. It seems possible that these accidents may have been due to the operator's slowness in making an adjustment to a new situation. In this case it was necessary for him to adjust himself to a single one-man car, after operating a heavy train, but he apparently found difficulty in doing so. Further weight is added to this hypothesis when it is realized that on the route run during the rush hour he had but one accident, whereas he had the three after the rush hour. In addition it may be somewhat significant that in 1928, when he was scheduled on but one route for both morning and afternoon shifts, or contrasted with other years when they were mixed and varied, he had but one accident for which he was not exonerated. However, even this is complicated by the amount of overtime which this man made, when he was not confined to that one route.

DATA RECORD

No. Y Name B Record on 18 yrs.
23 yrs. for accidents

Age 56 Yrs. of Service 28 Ht. 6 ft. Wt. 200 B.P. 150/86

Vision—Acuity 25-20 Color O.K. Glasses, No

Physician's notes:

Personal Data: Only daughter teaches high school. Takes life easy, good worker.

Previous Occup. teamster and laborer Breaks in Employ No

Yearly earnings:

1924 $3119 1925 $2999 1926 $3361 1927 $2717 1928 $2914 1929 —

Sick ratio 6 4 Misses 1 Leaves Setbacks refused
(one of 11 days in 1927)

Delinquencies:			
Over & Shorts	129	Fare Irreg.	23
Day Card		Signs	20
Minor	70	Other	

Personal Habits:

Operating Habits:

Minor				*Major*		
Late	4	Poor Oper.	13	Ahead, fast	32	12
Jerky		Talking,		Derailment		
Safety Stop	5	hands off	6	Passing red		
		Spec. work		light		

Insubordination and complaints 8

Former Diagnosis

Further Information

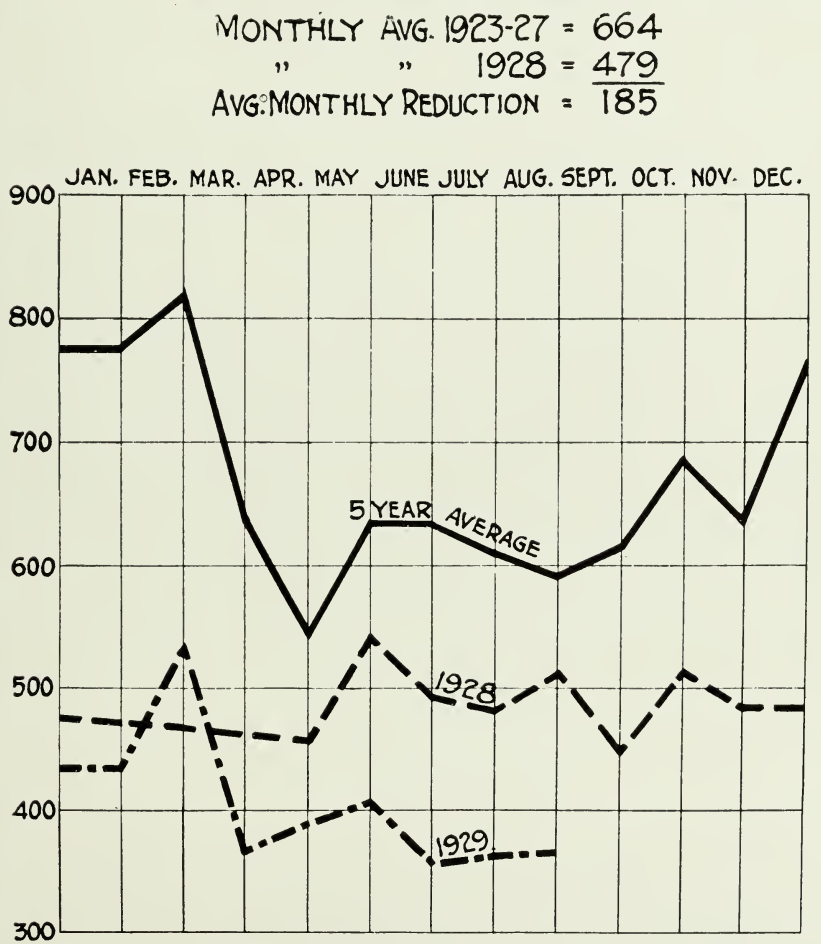
SUMMARY OF DATA

Medical record is good with very few absences on account of sickness. Very outstanding is the overtime put in by this man. He has netted an average of somewhat over $3,000 per year for the past five years. No setbacks have been refused and there is but one miss. However, in the matter of delinquencies his record is poor, being by far worse than that of his high accident mate. As to operating habits, he has been reported for poor operation 13 times

and for running too fast 12 times. Most of these occurred before 1914, however. There are only four lates, but 32 ahead. The man has one daughter who is a high school teacher. He is reported to "take life easy" and to be a good worker.

Summary of Accidents and Diagnosis from Data

Low accident man. In spite of extreme overtime he has had but three accidents in the past three years. However, his routes have not been for the most part of the high accident type.



Number of Collision Accidents (Surface Cars) Each Month 1928 in Comparison with 5-Year Average

It would seem that though he is not particularly careful nor extremely conscientious, he is an operator of great ability and can consequently get along with few accidents.

Diagnosis from Tests

This man's record is a perfectly clear one. The man is a non-oscillator, non-perseverator. His reaction time is fast throughout and he is scored as alert. One would certainly expect him to have an accident record at least as low as he has.

Conclusion

Operators should be divided into three classes:

1. First-rate operators who never have more than a few minor accidents. In our studies, these were found to constitute about 73.6 per cent of all operators.

2. Operators who, for one reason or another, do not ordinarily operate in a safe manner unless special methods of instruction are adopted, but who would always be classed as high. These comprise 20.5 per cent of the total. It is toward this class of operators that the present system of accident reduction has been directed. It has attempted to improve permanently the standard of operation of all these men. There are, perhaps, some men who, owing to physical or mental limitations, are constitutionally and inherently unfit for street-car work. This group does not include more than 2 per cent of the operators.

3. Those operators who are likely to be either in the high-accident or the low-accident class in any year. These men are: (a) Those who are qualified in all classes of services, conductor, car operator, and bus, who change from one type of operation to another; (b) those whose health, family circumstances, etc., either improve or become worse in any year. They form 6.6 per cent.

The function of the safety organization then has been threefold:

1. To reduce the number of high-accident men.
2. To follow up the men whose manner of operation has improved and crystallize their improved habits.
3. To prevent those men, who, due to change of operation, will have a tendency to come into the high-accident class.

PART IV

Development of Co-operation Between Management and Employees

PART IV

Development of Co-operation Between Management and Employees

In presenting this phase of its activities the Railway has selected as typical, first, the educational program which has come to have a conspicuous part in personnel relations on this property; second, the monthly bulletin, "Co-operation," which is sent from the general manager's office to the homes of all employees; and third, other means used by the manager in fostering good employee feeling and utilizing the play spirit in developing teamwork.

The Elevated's Educational Program

In the spring of 1929 the Railway closed its seventh season of industrial education. Certificates for the completion of courses were awarded to 567 persons, the total number of certificates being 830.

These certificates were awarded for completion of courses in selling car rides, public speaking, effective speech, correct English, motor vehicles, law for everybody, home nursing and first aid, arts and crafts; for group conferences of the maintenance, rolling stock and shops and transportation departments; for foreman conferences; for a correspondence course on the A B C of the electric car and for regular attendance at meetings of the Boston Elevated Railway Supervisors' Association, the meetings of which are partly of an educational character.

The educational program of the Boston Elevated Railway is designed to meet the desires of men and women employees for training to fit them better to perform their work and to broaden their mental horizon. Practically all instruction is given on the employees' own time, in the evening for day workers and in the morning for night workers.

To appreciate the splendid spirit of the Elevated educational groups it is necessary to see them in action. Many prominent visitors to the classes testify to their delight in what they see and hear. Without any desire to be spectacular in its educational program the Railway has come to be regarded as the leader in this field.

The educational program is credited by the management with a steady development in co-operation and general morale, without

GROUP IN ATTENDANCE AT CLOSING EXERCISES OF 1927-28 EDUCATIONAL PROGRAM

These exercises were held at the Instruction School, Sullivan Square, on Thursday, May 3, 1928, General Manager Edward Dana, presiding.

which the recent remarkable achievements in accident reduction would have been impossible.

Co-operation with Outside Agencies

Participating in the past season's program on the Elevated property were the Department of University Extension of the Massachusetts Department of Education and the Boston Metropolitan Chapter, American Red Cross.

Several courses were given by instructors of the Division of University Extension under the auspices of the Railway's committee on education, and the Railway was thus able to hand to many employees certificates of their accomplishment supplied by the State Department of Education.

Similarly the Red Cross Society furnished, from Washington headquarters, standard certificates for a large group of young women who took the prescribed course, modified to suit "El" requirements, at local Red Cross headquarters, but under the auspices of the Railway.

The Railway has its own standard certificate, which is awarded to all employees who meet the requirements in any of its courses in which the other certificates mentioned are not awarded.

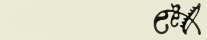
This close co-operation with state and national educational agencies is an element of strength in the "El" educational program.

Not only is the program conducted with the aid of the institutions mentioned, but the Boston School Committee, and the universities, colleges and special schools in which the community abounds, all co-operate heartily in this work. The American Electric Railway Association is of great assistance. As chairman of the Association's committee on education for many years and later of the committee on industrial relations, the general manager of this railway is in close touch with all developments in the personnel field. Illustrating the co-operation thus enjoyed, the guest speakers at the closing exercises of the past season were William B. Snow, assistant superintendent of schools, Boston, Mass., and James P. Barnes, president of the American Electric Railway Association.

Foreman Conferences

The progress in this line described earlier was achieved by means of a plan based upon co-operation. Many of the minor offi-

All Progress Begins in the Brain



SUCCESS in the electric railway business, individually and collectively, depends on the use that is made of each worker's ability to think straight. To be sure, if the majority are mentally alert, the minority can muddle through without much mental effort. But the best results can be secured only when every employee is making the most of his mental equipment.

On this property the working conditions are such that few employees leave the service, the "labor turnover" is negligible. This means that the average term of service is long and will be longer. Such a condition has many advantages, *but with it goes the danger of getting into a rut.* The only safeguard against this is mental alertness. This in turn means study of some sort, using that term in a broad sense and not in the sense of cramming from text-books.

The educational program set forth in this leaflet* is designed to help keep us all out of a rut. There are few employees who could not take some part in this program with profit to themselves.

Edward Dana

*This article by Mr. Dana was the introduction to the educational prospectus of the 1927-28 season.

cials who carry out the details of the plan, in direct contact with the working force, were trained in the foreman conferences. Membership in these conferences has totaled hundreds, although an individual conference is made up of a small group, fifteen to twenty being the upper limit.

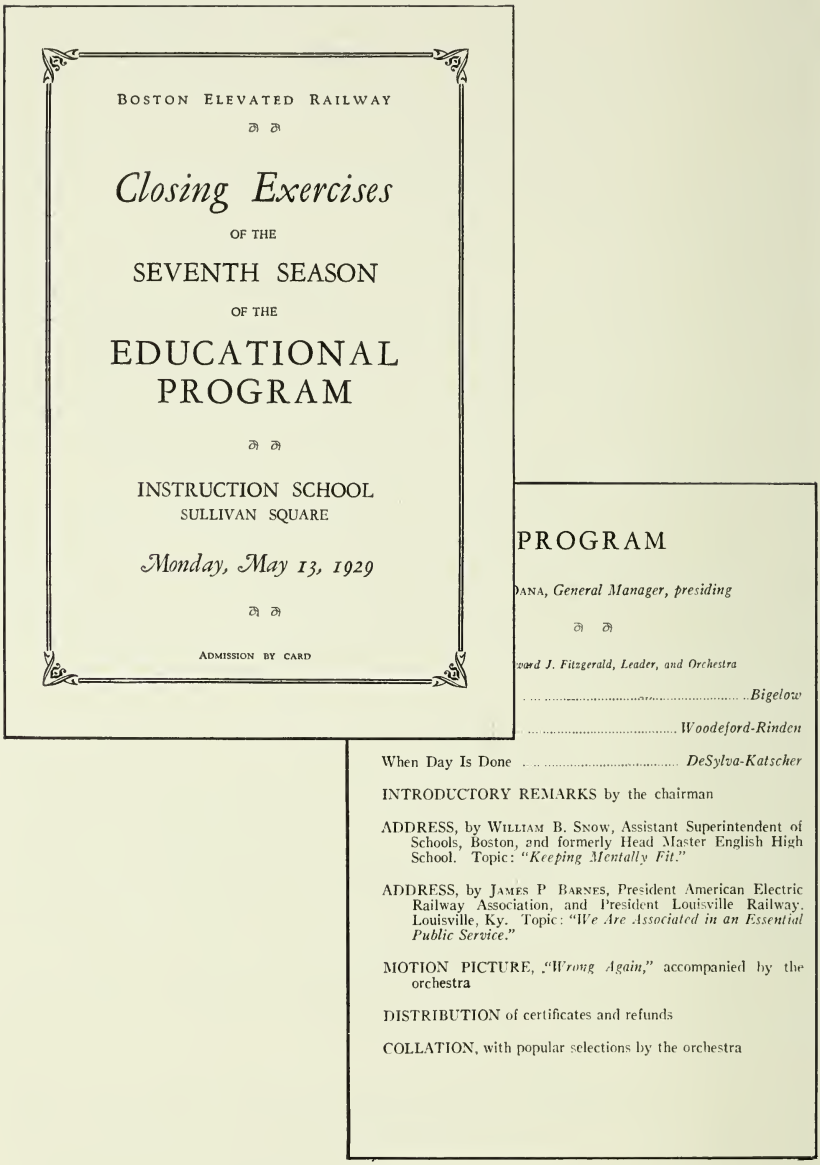
In the foreman conferences, which many men have attended for four consecutive years, the fundamentals of foremanship are discussed by means of the "case method." This term "foremanship" is interpreted as anything that has to do with supervision over, and responsibility for the work of others. Such topics as the causes and cure of carelessness, promoting interest in the job, effect of working conditions upon morale, discipline, job analysis, qualifications of a good supervisor, etc., are discussed. The men also study practical economics, with interpretation of statistics. What such study by foremen on their own time and without compulsion means to the management can well be imagined.

But foreman training, important as that is and successful as it has been on the Railway property, is only part of the program as was indicated by the list quoted above. Any of the courses mentioned, whether covering a subject related directly to everyday work or not, is useful in promoting co-operation, which must be based on acquaintance and mutual respect among employees.

By-Products

And the by-products are of no mean value, either. To illustrate: In the public-speaking class the subject of debating was a feature. It was a natural outcome that the class should challenge to a joint debate a similar class in the Edison Electric Illuminating Company of Boston. The challenge was accepted and the debate was held, with consequent fostering of good feeling between the utilities and stimulation of educational interest in both. A further result was a plan for an inter-utility debate league which is now forming.

Another illustration: In a course on accounting a lecture by the head of the "El" bueau of audit led to the appointment of an inter-departmental committee to co-operate on matters affecting accounts and records. The result was a substantial money saving to the Railway and an enhanced spirit of co-operation among departments.



BOSTON ELEVATED RAILWAY

Closing Exercises

OF THE

SEVENTH SEASON

OF THE

EDUCATIONAL PROGRAM

INSTRUCTION SCHOOL
SULLIVAN SQUARE

Monday, May 13, 1929

ADMISSION BY CARD

PROGRAM

)ANA, *General Manager, presiding*

ward J. Fitzgerald, Leader, and Orchestra

..... *Bigelow*

..... *Woodeford-Rinden*

When Day Is Done ..... *DeSylva-Katscher*

INTRODUCTORY REMARKS by the chairman

ADDRESS, by WILLIAM B. SNOW, Assistant Superintendent of Schools, Boston, and formerly Head Master English High School. Topic: *"Keeping Mentally Fit."*

ADDRESS, by JAMES P BARNES, President American Electric Railway Association, and President Louisville Railway, Louisville, Ky. Topic: *"We Are Associated in an Essential Public Service."*

MOTION PICTURE, *"Wrong Again,"* accompanied by the orchestra

DISTRIBUTION of certificates and refunds

COLLATION, with popular selections by the orchestra

PROGRAM OF 1929 CLOSING EXERCISES IN EDUCATIONAL PROGRAM

A third illustration will be found in an appendix: In this case the interest in a lecture by the Railway's general attorney led him to devise a general educational plan for accident reduction, resulting in an ingenious method for getting the message to employees and the sending of two large groups of car men to congresses of the National Safety Council.

One of the most notable by-products of the educational program was an outgrowth of the foreman conferences. Realizing the value of the close association brought about by these conferences, the members of the several groups appointed representatives on a special committee to devise some way by which the benefits could be brought to a wider circle. It required a year or more to reach a conclusion as to the best plan, but finally the Boston Elevated Supervisors' Association was formed. It rounded out its second highly successful year last May.

This association comprises nearly five hundred men occupying supervisory positions and representing all departments of the Railway. Monthly meetings are held, with programs of entertainment and instruction. Many prominent men within and without the industry have spoken at the meetings. Through the association a spirit of comradeship has been fostered.

The success of the Supervisors' Association in Boston has aroused much interest throughout the industry and other railways have found the experience here to be helpful to them in their own organizations.

Historical Review

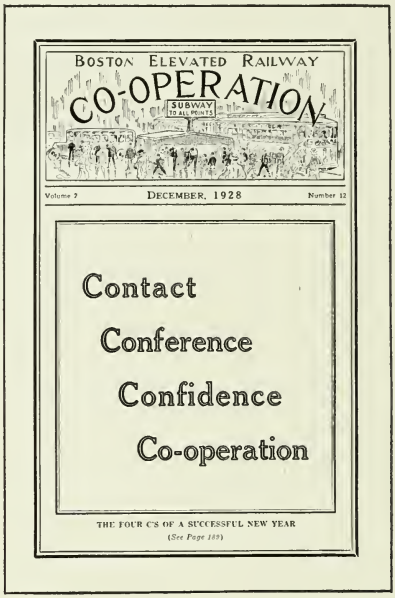
To understand the present status of the educational program of the Boston Elevated Railway it is necessary to review its development since 1922.

The seventh season's program was a logical development of what had gone before and illustrates the desire of the management to afford every employee an opportunity to develop to the limit of capacity.

The general manager of the Railway, a college-trained man, has long been a believer in the possibilities of education on the job. He therefore, in 1922, welcomed an offer of co-operation on the part of the Division of University Extension of the State Department of Education, and a course in practical electricity was provided. This proved to be popular and, of the approximately 330 enrolled

To All "El" Employees

IN these monthly editorials we have emphasized four essentials of good employer-employee relations. These were listed conspicuously on the front cover of the December, 1928, issue of "Co-operation," reproduced below on a reduced scale.


BOSTON ELEVATED RAILWAY

CO-OPERATION

SUBWAY TO ALL POINTS

Volume 7 DECEMBER, 1928 Number 12

Contact

Conference

Confidence

Co-operation

THE FOUR C'S OF A SUCCESSFUL NEW YEAR

(See Page 189)

Let us focus attention upon the third essential, confidence, which is the natural result of contact and conference.

Confidence means belief in the integrity and ability of one's colleagues, one's fellow-workers. Without it no man or woman can be happy in work or can work well.

It is worth a lot of effort, if such is necessary, to gain such confidence.

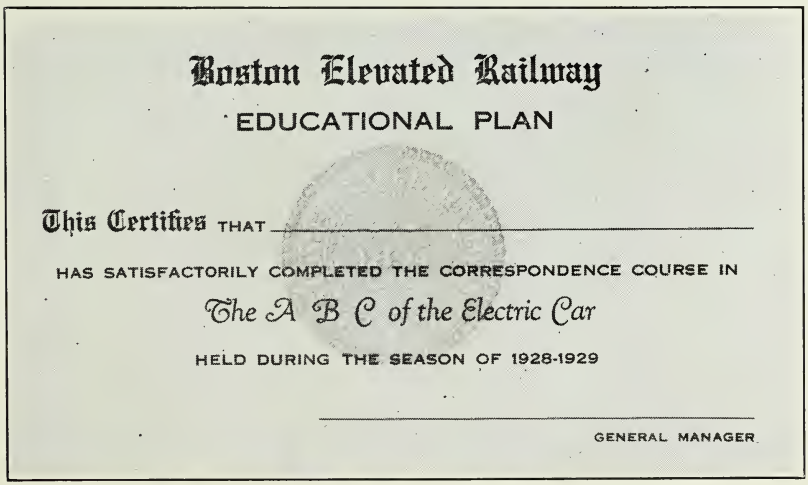
Edward Dana

in the course, 140 received certificates. The Railway refunded the fees for all who completed the course.

In 1922 also a co-operative course was inaugurated in connection with the Massachusetts Institute of Technology under which a student for three years spends alternate periods with the Railway and at the Institute, beginning with the third year of the college course. The Railway agreed to take two co-operative students each year, making a total of six at any one time. This co-operation has continued and is considered a permanent part of the Railway's program.

The success of the first year's course in practical electricity led to a repetition of this course the following year, and in addition a course in dynamo-electric machinery was conducted. The outstanding feature of the 1923-24 program, however, was a course in public utility economics, given by L. R. Nash of Stone & Webster, also under the auspices of the Division of University Extension.

With the third educational season in prospect the general manager called into consultation a man who had had considerable educational experience, and was familiar with the electric railway industry to advise regarding the next steps to be taken. The result was a plan for departmental group conferences. These comprised the program for the coming season. In each of four departments a series of 20 conferences was held and there was also a series of 10


Boston Elevated Railway

EDUCATIONAL PLAN

This Certifies THAT _____

HAS SATISFACTORILY COMPLETED THE CORRESPONDENCE COURSE IN

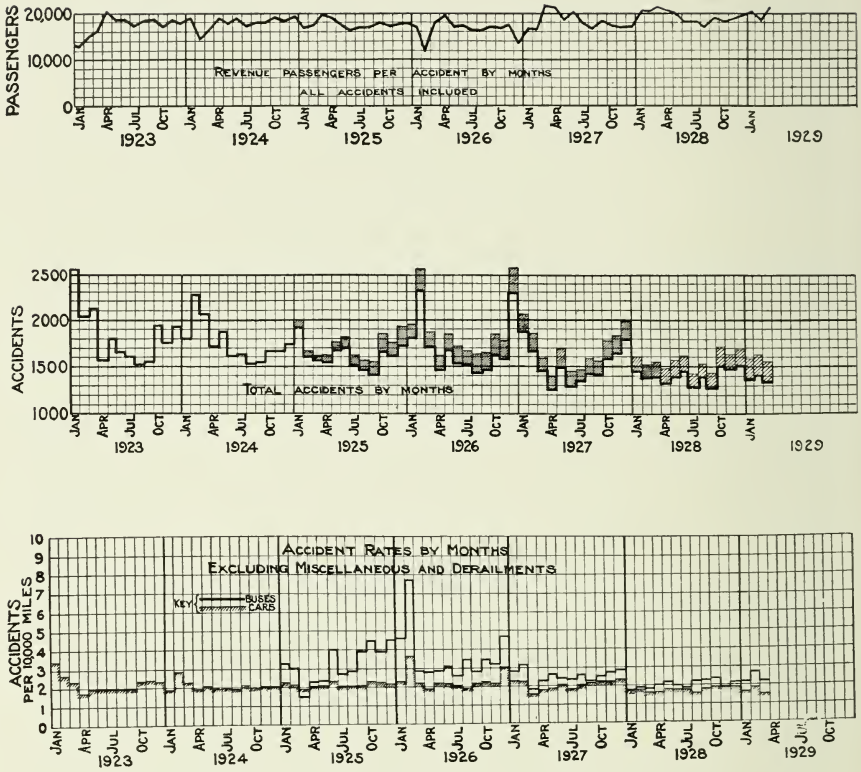
The A B C of the Electric Car

HELD DURING THE SEASON OF 1928-1929

_____

GENERAL MANAGER

Sample of Certificates Awarded in Educational Program



ACCIDENT DATA AS DEPICTED IN "CO-OPERATION"

conferences for women employees. Nearly 1100 employees enrolled for these conferences. They laid the foundation for the more general program which was to follow.

By this time the management realized the necessity of having someone on the staff to devote his entire time to the educational work and an "educational advisor" was appointed. Under his direction a more extended program was laid out for the fourth educational season. A canvass was made to determine the preferences of employees, and courses in public speaking, public utility economics, correspondence and reports, inter-departmental accounts, investing savings, parliamentary law, accident prevention, transportation problems, timetable construction, selling service, business psychology, reading electrical diagrams, automotive maintenance, signals and signalling, current events, and correct English were offered and conducted. During this season a beginning was also made in foreman training, which soon came to be one of the outstanding features of the educational program.

Under the guidance of the educational advisor programs have been planned and conducted each season, culminating in the seventh program already referred to.

As already suggested, the educational program has provided a foundation for the present great interest in the accident problem. It has also provided much direct instruction in accident reduction. Details of the accident prevention phases of the educational program will be found in an appendix.

"Co-operation" a Factor in Promoting Esprit de Corps.

With the beginning of 1922 the general manager inaugurated a series of monthly bulletins to employees as a means of informing them of important developments on the property. This proved so acceptable that it was gradually expanded, the purpose, however, remaining the same. When an educational advisor was appointed in 1925 the preparation of "Co-operation," as the general manager's bulletin was termed, was turned over to him as an educational matter, the general manager, however, continuing his personal interest and editorial oversight. In 1928 the practice of mailing "Co-operation" to the homes of employees was inaugurated.

"Co-operation" is now the principal means of communication between the management and the employees. It is different from the general run of house organs in that it is virtually a circular

letter from the general manager to the Railway personnel. In it he tells them about the recent and contemplated developments on the property, interesting new machines purchased, changes in schedules inaugurated, etc. Pictures and diagrams are freely used. Data of various kinds in tabular and graphical form are given the employees as soon as released by the public trustees and before they are given to the public through the newspapers. It is evident therefore that the idea underlying "Co-operation" is to have the employees well informed, so that they will not only be interested in their work, but will be able to give the patrons accurate information when information is desired.

The last page of each number of "Co-operation" is probably unique in the field of utility employee publications. It contains the essentials of the last-minute reports of the bureau of audit and other departments, as to business done, revenue received, balance on hand, service furnished, etc. Accident data "up to the minute" are given among other items. These show car and bus accidents respectively per 10,000 miles and the revenue passengers carried per accident.

Going to the homes of employees, the little paper is eagerly read by members of employees' families and through them the information contained is widely disseminated. The daily and technical press makes extensive use of the material appearing in "Co-operation."

To each issue of "Co-operation" the general manager furnishes a signed editorial which conveys a timely message. These editorials refer frequently to safety. Several of these editorials will be found scattered through the pages of this presentation.

Other Activities of General Manager in Establishing Intimate Contacts With the Employees

The spirit of co-operation existing on the Boston Elevated Railway property between the management and the employees is typified by a letter sent early in 1929 to nearly 1,100 men in the transportation department who operated cars during 1928 without an accident chargeable to them. The text of the letter follows:

"It has been reported to me that you are among those men who during the year 1928 maintained a clear accident record; that is, you were not involved in an accident in which in any way you contributed to its occurrence.

"It is most gratifying to find that there were 1,093 men in this class, and the management takes this opportunity to express its appreciation of your carefulness. You have reason to feel proud that in the conduct of duty you had a realization of your responsibilities about you at all times.

"Last year the accident cost to the car rider amounted to $1,502,313, and when we realize the suffering entailed, as well as the fact that this money is, as far as the car rider is concerned, a complete waste which could be used to his advantage much better by providing added service, we can appreciate the need for exerting every possible effort to reducing this toll.

"It is our hope that for your own sake, as well as the sake of the service, you will continue this good work and that in other respects also your year may be a pleasant one for you.

"Very truly yours,

"EDWARD DANA,

"General Manager."

Another evidence of good relations which, while not occurring during 1928, had an important bearing on the safety record of that year, was the sending of delegations of car men to the National Safety Congress. As explained elsewhere, ten men were sent to the 14th Congress held in Cleveland in 1925 and fifteen were sent to the 15th Congress held in Detroit in 1926. In the latter year also one hundred $10 gold pieces were given as prizes to the same number of men who submitted the one hundred best examination papers following those which entitled the writers to the trip to the Congress.

Good working conditions play an important part in co-operation in accident prevention. The Boston Elevated Railway is a pioneer in the transportation field in the adoption of the six-day week for all employees. Heretofore

1093 CAR MEN

HAD

NO CHARGEABLE ACCIDENTS

IN 1928

it has been considered necessary for the considerable part of the employees in the transportation department particularly to work seven days a week. The Railway is also a pioneer in providing vacations with pay for wage earners who ordinarily do not expect such vacations. Car men are now being given one week vacations. This has recently been increased to ten days and will soon be increased to two weeks. It is expected that the extra co-operation promised by the men as a result of this concession will have a marked effect upon the accident situation.

ACCIDENT PREVENTION

Questions Relating to Duties of Rapid Transit Guards

NAME BADGE NUMBER HOME ADDRESS

QUESTION 1. Give two reasons why you are interested in trying to prevent accidents.

Answer.

QUESTION 2. State fully what you should put in your accident report.

Answer.

QUESTION 3. What is the best way to approach a person whose name you want as a witness and what should you say to him or her?

Answer.

QUESTION 4. In making a report of persons who witnessed an accident, which of the following do you consider correct? 1. William Jones, Cambridge, Mass. 2. William Jones, Harvard St., Cambridge. 3. William Jones, 235 Harvard St., Cambridge. Why?

Answer.

QUESTION 5. What can you do to prevent door accidents?

Answer.

QUESTION 6. What can you do to prevent accidents generally? Answer as fully as space permits.

Answer.

QUESTION 7. What can you do to help the Railway and your fellow employees in their relations with the public?

Answer.

QUESTION 8. When your automatic starting signal fails to work what do you do?

Answer.

QUESTION 9. What should you observe and what should you do to prevent accident to a person boarding or alighting from your train?

Answer.

QUESTION 10. If you should make a mistake in making out your accident blank what would you do to correct it?

Answer.

QUESTION 11. Describe disorderly conduct as defined in your rules.

Answer.

QUESTION 12. Why is it important to turn in all original slips or notes made at time of accident with your accident blank?

Answer.

QUESTION 13. On whom does the cost of accidents directly fall and why?

Answer.

QUESTION 14. Is Accident Prevention helpful to the Railway and the public? Give your reasons.

Answer.

QUESTION 15. If you have had an accident what are two important things to do? State in the order of importance.

Answer.

QUESTION 16. Have you read the Accident Prevention circulars? If you have, state what help they have been to you.

Answer.

QUESTION 17. Who make the better witnesses before a jury—employees or passengers? Give reasons for your answer.

Answer.

QUESTION 18. What can you do to prevent "falling in car" accidents?

Answer.

QUESTION 19. What can you and your fellow employees do to help better the good reputation of the Railway?

Answer.

QUESTION 20. Should all the doors of your train be closed before it starts and why?

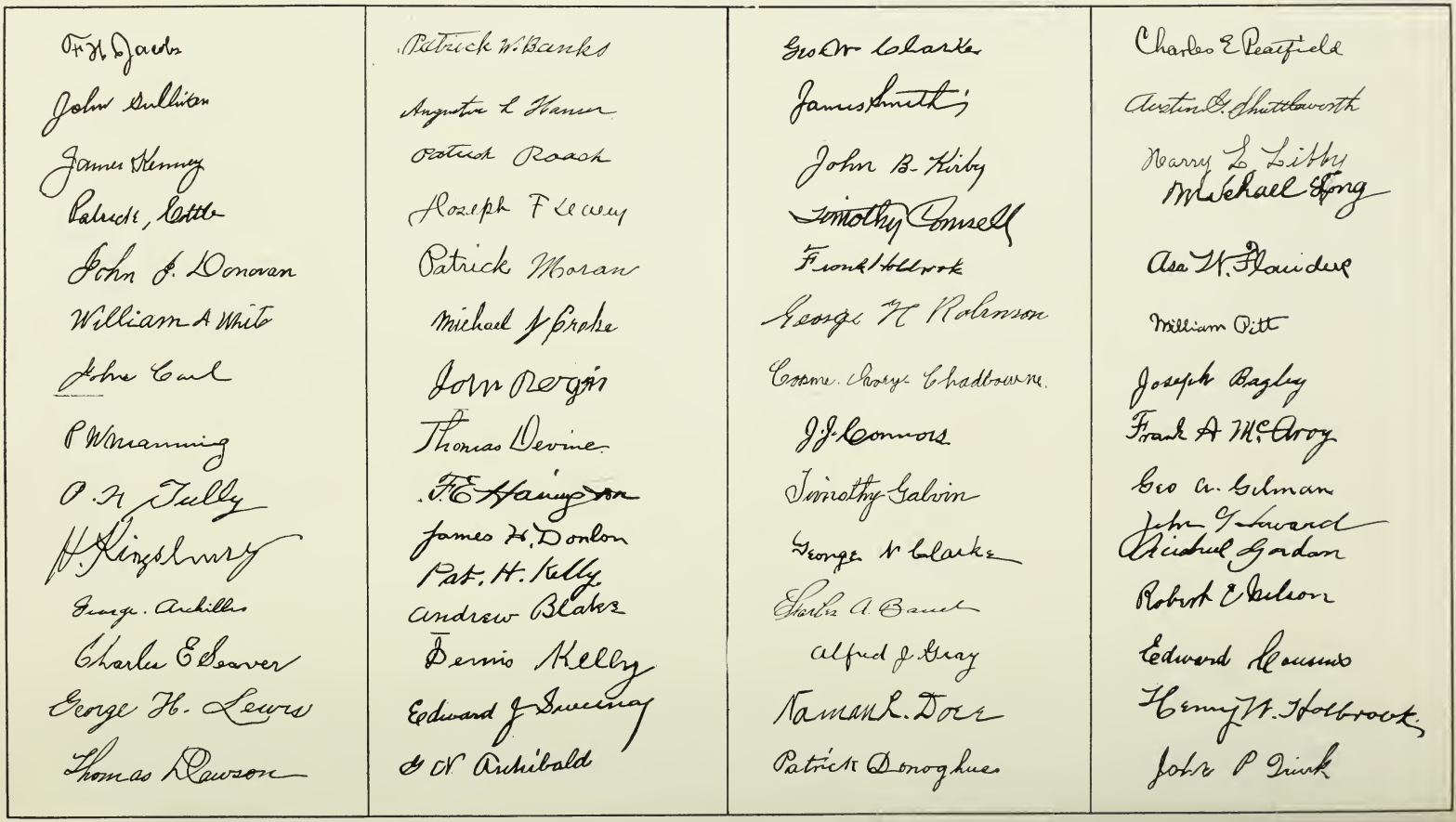
Answer.

EMPLOYEES SUGGEST SAFETY MEASURES

One good way to secure the co-operation of employees in accident reduction is through their suggestions. Thus in the department of rolling stock and shops of the Elevated the employees are encouraged to express their views on safety freely and to make suggestions for improving conditions in shops and car equipment. All suggestions are promptly acted upon and put into effect if, after discussion, they are found to be practicable. Otherwise the men are informed why their suggestions are not applied.

In this department bulletin boards are provided in lobbies for displaying safety posters.

The sending of car men to the annual safety congress has already been mentioned. The men for this purpose were selected by means of an examination. The questions were selected to fit different groups of employees. A sample set of examination questions is inserted. This examination aroused great interest and its influence extended far beyond the ranks of the men who participated.



AUTOGRAPHS OF MEN GIVING FORTY-FIVE OR MORE YEARS OF SERVICE

Playing Together Helps Reduce Accidents

One element in co-operation along accident reduction and other lines is the fraternizing of employees and officials in recreational activities. Handball courts are to be found in some stations, and there are many bowling teams on the Elevated property. Contests among the bowling teams are followed with great interest. (There are two bowling leagues made up of numerous teams, which foster regular playing by their members. Records of members are carefully kept and at the close of the season the members dine together and award prizes for the best records. The Elevated teams participate also in seasonal competitions with teams from other companies.

Recognition of Long Service

Early in 1927, realizing the desirability of recognizing very long and faithful service with the Railway, the general manager tendered a luncheon at the Engineers Club in Boston to the twelve employees who had been in service 50 years or more. The reaction was so good that the following year he invited all men who had given 45 years or more of service to the Railway to have luncheon with him. This group included fifty-eight men.

While these luncheons were delightful occasions, it seemed desirable to award these veterans something of a more tangible character as an evidence of faithful service. A gold emblem, with pin attachment, especially designed, was therefore given to each man toward the close of 1928, and soon thereafter the group was enlarged to include, first, the 40-year men and then the 35-year men.

Emblem—Actual Size

Emblem—Enlarged

The total of employees and pensioners (who were active when the emblems were awarded) is now 411, made up as follows:

50 year men	15
45 year men	60
40 year men	108
35 year men	228

This recognition of long service is one of the best things the management has done to promote a cordial feeling between employees and management.

In awarding the pins the general manager sends a personal letter of appreciation of the service which the pin symbolizes, reading somewhat as follows:

"As an employee who has given to the Railway 40 years or more of service you are entitled to the solid-gold pin which has been prepared for you showing by its color, by the number of stars (each representing 5 years) and by the lettering the length of your service.

"Do not hesitate to wear this on duty and elsewhere as it will be a constant reminder of your long and faithful term of service.

"With kindest personal regards, I am

"Yours sincerely,

"EDWARD DANA,

"General Manager."

These long-service emblems are proudly worn and highly prized, as is evidenced by testimony which reaches the general manager's office. In fact, the management is so pleased with the results that in time the "long-service club" will be enlarged to include 30-year men and possibly 25-year men.*

There is an accident slant to this matter in addition to further fostering of a spirit of co-operation. The long-service men have been shown by statistics to be safer operators of cars and buses than the men of less experience, and are presumably safer employees in fields other than car service. Hence anything that tends to encourage continuity of service is a safety measure.

A Liberal Pension Plan

Contributing in no small measure to the feeling of security enjoyed by the Boston Elevated employees is the generous pension

*Since this presentation was made emblems have been awarded to the 30-year men and women, and preparations are being made to include those who have served 25 years.

plan inaugurated by the public trustees. Four classes of employees are eligible to receive pensions, as follows: (a) males 65 years of age or over, and females 60 years or over, whose term of employment has been twenty years or more; (b) males from 60 to 64 years of age, and females from 55 to 59 years, whose term of employment has been twenty-five years or more; (c) males whose age is less than 60 years, and females under 55 years, whose term of employment has been thirty years or more; (d) employees who have become totally disabled as a result of sickness or of injury, other than accidental injury, arising out of and in the course of employment by the company and whose term of employment has been fifteen years or more. In class (d) pensions are granted for such period as the pension committee may determine at the discretion of the committee and with the approval of a member of the Board of Trustees. Employees in class (a) may be retired on pensions at their own request or at the discretion of the committee, while employees in classes (b) and (c) may be retired on pensions only at the discretion of the committee.

The annual amount of pensions paid is one per cent of the average yearly earnings for the ten years prior to retirement for each year of continuous employment, but the amount shall not be more than $2,000 nor less than $375 per year. Thus, if an employee's average annual wage for ten years is $1,250 and he has been in service thirty years he would receive $375 per year, or $31.75 per month.

Payments are made on the first of each month after retirement until the death of the employee unless suspended for gross misconduct or any conduct prejudicial to the interests of the Company. If a male pensioned employee is survived by a widow dependent upon him, or if either male or female employee is survived by minor children dependent upon the deceased's support, the pension may be continued for three months after death.

It is provided that neither the action of the Company in establishing the pension plan or any action thereafter taken by the Company, or the Board of Trustees, or the Pension Committee, shall be construed as giving any officer, employee or agent of the Company the right of service, or any legal right to a pension.

The Company also reserves the right to reduce all pensions pro rata so that the entire expenditure for pensions during any year shall not exceed 2 per cent of the salaries and payroll for that year.

Any retiring employee may, having first obtained the approval of the committee, engage in any occupation or work which is not prejudicial to the interests of the Company, but regular employment by the Company suspends the right to a pension while the employee is so engaged.

Employee Advantages Derived from Special Insurance Compensation Plan

Compensation insurance for employees of the Boston Elevated Railway is handled through the Transit Mutual Insurance Company, organized primarily for this purpose. In addition to economies in administration which this arrangement makes possible, employees benefit by prompt payments, more specialized surgical and medical treatments. Light work is found for partly disabled men by close co-operation between the employer and the employee.

The loss ratio of the Insurance Company, that is, the percentage of payments for losses, as compared with premiums received from the Railway, closely reflects the situation on the Railway property from the industrial accident standpoint. This ratio for 1928 was 45 per cent, as compared with 51.4 per cent in 1924; 55.3 in 1925; 61 in 1926, and 73 in 1927.

The manager of the Insurance Company attributes this good record to the active co-operation of officials, semi-officials and employees generally who have shown a decided interest in the prevention of industrial accidents.

PART V

Measures to Promote Safety and Health of Employees

PART V

Measures to Promote Safety and Health of Employees

The safety and health of employees have been of primary concern to the Railway. In every piece of new construction or in the improvement of existing buildings, any methods of accident prevention already successfully effective on other railways have been adopted on the property of this railway wherever possible. Moreover, in order to meet its own peculiar conditions, the Railway has originated and perfected methods and engineering devices promoting industrial safety.

In the interest of clarity, the Railway's work in industrial safety will be presented with respect to what has been done in (a) car houses and yards, (b) shops, and (c) garages. Then will follow a description of special work in the maintenance and other departments. Outstanding accomplishments in sanitation and health work and in the prevention of fires will be outlined. And, finally, the actual reduction in employee accidents over the last five years will be discussed and presented in graphic form.

Car Houses and Yards

Pits of steel with concrete floors.

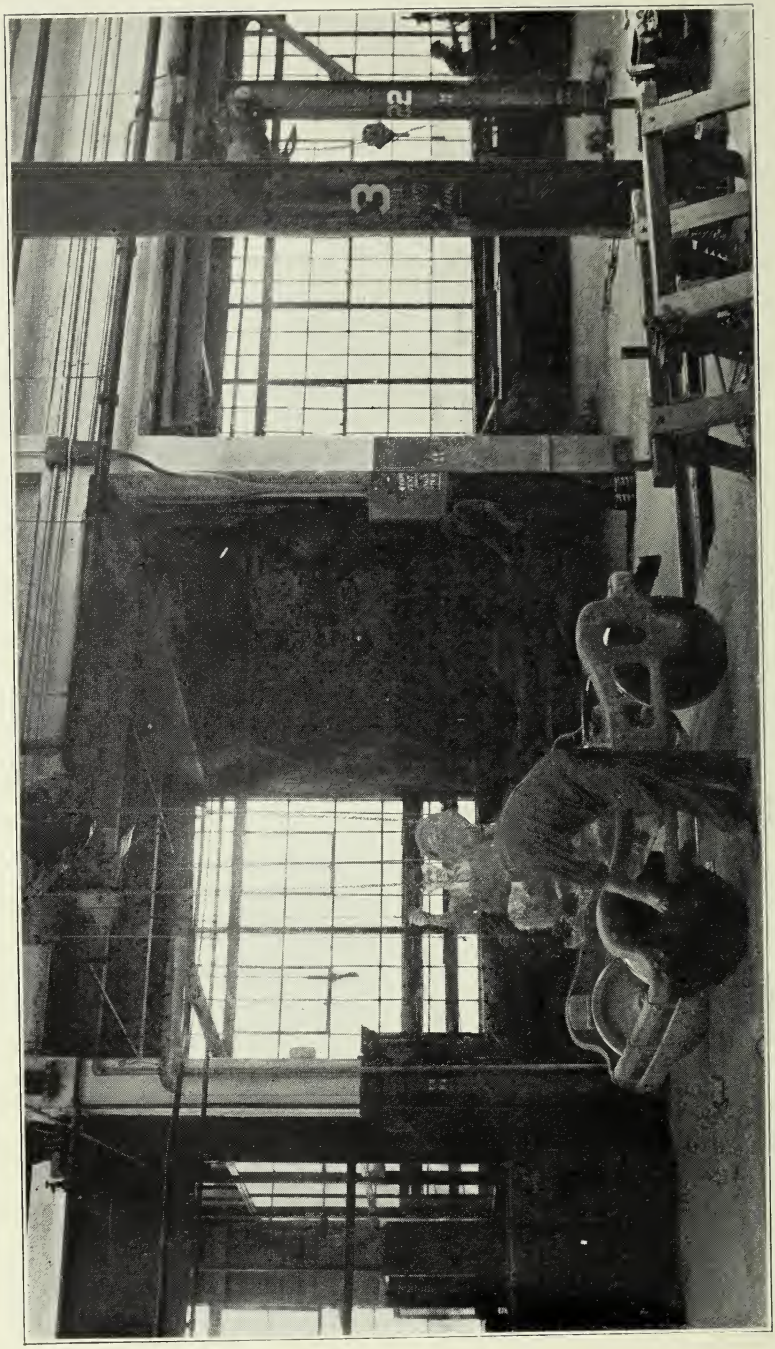
The pit construction in car houses is of steel with concrete pit floors well drained. The rails are welded to the steel pit structure with standard clips. This type of construction assures more permanently safe support for the cars than the old type wooden construction.

Hoists and cranes in car houses.

Car houses are equipped with modern car-body hoists served at either end with a 5-ton jib crane and electric hoist for handling repairs. These hoists and cranes do away with the former dangerous method of using jacks and horses.

Safe car clearances in yards.

In laying out new car yards, the tracks and special work have been so designed to provide safe clearance for employees. Special



HANDLING TRUCKS WITH 5-TON JIB CRANE

attention has been given in this respect to rapid transit yards where the making and breaking of trains is done.

Elevated platforms eliminate hazard in removal of snow and ice.

The accident hazard to employees incidental to the removal of snow and ice from the roofs of subway and elevated cars has been eliminated by the construction of elevated platforms at the rapid transit yards. Formerly the cars were brought into the shops and the men were sent on to the roofs to sweep off the snow. There was some hazard in connection with this work. The elevated platforms erected in the yards are of such height that the men can remove the snow from the roofs without climbing on top of the cars.

Safe drainage of reservoirs.

The Railway endeavors to make it unnecessary for men to get under cars to make adjustments. A recent development in this line is the extension of the drainage pipe attached to the air reservoir on center-entrance cars so that a man can bleed the reservoir without going under the car.

Rules governing car house employees.

For the guidance and protection of car house employees in their work, a set of rules was prepared by a committee of the department of rolling stock and shops and after approval by the management was put into operation. These rules follow:

BOSTON ELEVATED RAILWAY

These rules apply to operation of cars on the Company's premises. Surface Lines Rules for Conductors and Motormen must be followed while operating cars on street.

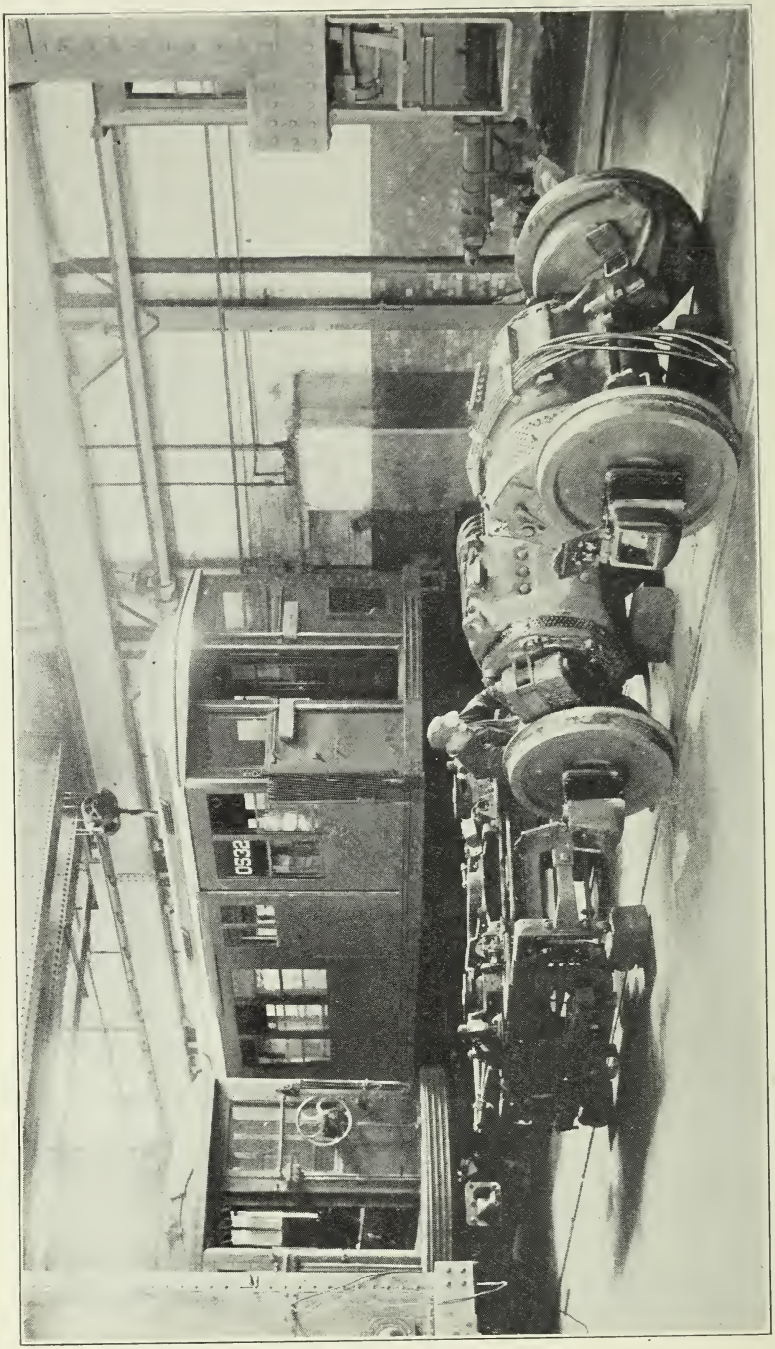
To Surface Lines Car House Employees:

The following rules are prescribed for the prevention of accidents and must be strictly observed.

1 Operators must be in proper position on platform before car, train, plow or transfer table is started.

2 Overhead switches must never be thrown on until operator is sure that controllers are in *OFF* position and that no one is working on the car.

3 Air brake cars must never be moved with less than thirty-five pounds of air, except when air brake is disabled, and then special precaution must be exercised with hand brakes.



PRESENT METHOD OF DOING TRUCK AND WHEEL WORK—MEN WORKING ON FLOOR

4 Trailer trains must never be backed except when in charge of two men; one man must operate same from end of motor car nearest the trailer and the other man must signal the operator from a position where he has observation of the track in direction of car movement.

5 Single cars must never be backed unless special safety precautions have been taken.

6 Coupling of trailer cars must always be done by two men, one man operating the motor car and the other man tending draw bars.

7 Transfer table gongs must always be rung before transfer table is started.

8 Employes must not, when holding trolley, walk between risers of transfer table when the table is in motion.

9 Under no circumstances must an unauthorized person be permitted to operate the car.

10 Employes must never go between cars to put on trolley until they know that the controller is at *OFF* position and that the main motor switch is open.

11 More than full series of power must never be used for operation of cars except in case of test.

12 Cars should never be pushed without being coupled together except when it is impossible to couple them, and then special precaution must be exercised.

13 Employes must not ride on draw bars, fenders or bumpers for any reason.

14 Before starting car employes must sound gong and know by personal observation that no one is in a position to be injured by movement by car.

15 Main fuses must be removed from cars under which employes are working.

16 Jumping from roof of one car to roof of another is permitted only by trolley inspectors and sign shifters, and then only when cars are less than two feet apart.

17 Car cleaners must know that light, heater, pump and overhead switches are off before going onto roof of car.

18 Traps must never be left open at night.

19 Rivet heads and bolts must be prevented from flying when cut off by the use of bagging, broom or other suitable method.

20 When jacking up cars, with employes underneath same, the precaution must always be taken of following up the jacking with blocking.

21 Tools, lamps or other material must never be left on the rail.

22 Employes are forbidden to throw anything around the carhouses.

23 In case of injury no matter how slight, employe must report same to his foreman at once unless he is physically unable to do so.

EDWARD DANA,
General Manager.

Enlarged copies of these rules are posted conspicuously in all car houses and, at the monthly fire drills and conferences on safety with day and night crews, the rules are read by some one of the group and the reading is followed by a safety talk.

Shops

As late as 1925, all repairs to car bodies and all painting of rolling stock were done in antiquated buildings where there were great congestion, inadequate lighting and ventilation. In these buildings there were innumerable posts, spaced originally for narrow cars, which broke up the floor space and introduced accident hazards. Now this work is done in modern shop buildings at Everett. In the new shops there is practically no necessity for artificial light during the day. There is a general air of roominess and neatness everywhere. The new shops are, in fact, models of their type.

Safeguarding wood shop.

In the new shops at Everett, the wood shop (especially the mill) was given particular attention. The selection of all machinery was governed from the viewpoint of safety as well as efficiency. All dangerous machinery is carefully safeguarded and a complete exhaust system of ample capacity insures the removal of all dust and shavings.

Machines located for safety.

In the Everett wood shop the location of each machine on the floor was studied in order that material being worked on at one machine would not interfere with, and become a hazard to work at another machine. A wide aisle running through the center of the mill permits material to be moved through without interference with the work being performed at any machine.

Safe paint shop.

The paint shop is roomy. It has ample working space between the cars, allowing free and safe use of wheeled stagings, ladders, etc. The paint storage and mixing rooms all have modern facilities for handling paint stock with minimum danger to the men.

Elimination of unnecessarily heavy labor.

No heavy lifting is required in the paint shop. A portable electric elevator raises barrels and other receptacles containing paint materials to the necessary height from which their contents are dumped into mixing tanks operated by power. The receptacles for mixing paints are provided with wheels so that they can be easily moved to the mixing apparatus, where a balanced paddle

wheel is dropped into the paint. After a thorough mixing the paint receptacle can be moved to one side and the contents drawn off as wanted.

Original portable painter's staging.

Another feature in the paint shop which was carefully studied was the staging for the painters. It was decided that much of the elaborate paraphernalia often used is an accident hazard rather than otherwise. The Railway, therefore, became a pioneer, so far as is known, in the adoption of the specially designed portable paint staging so arranged that without any adjustment a man can work at any height on a car and can move the staging along the car as his work progresses without leaving the platform. This staging is a real safety-first device and has attracted the attention of other railways which have copied the principle.

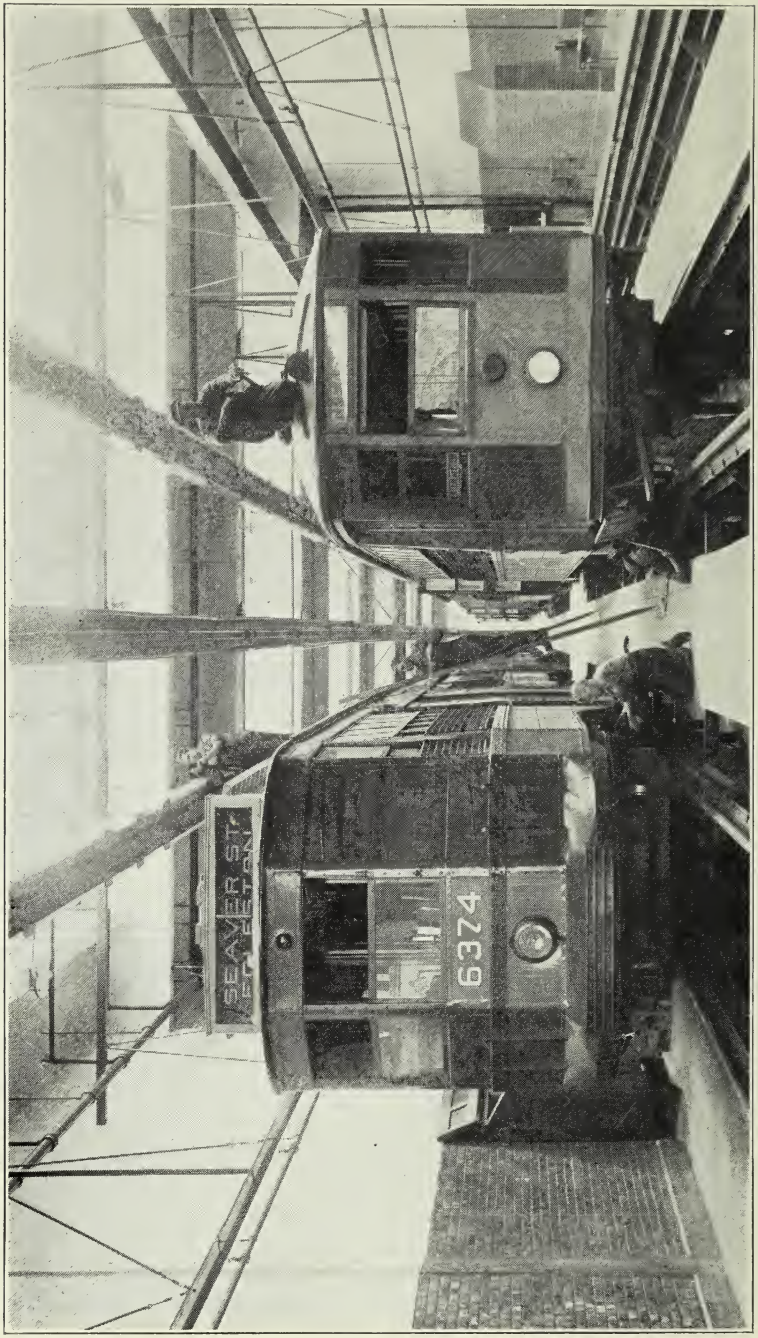
Safeguarding wheel work and truck repairs.

All wheel work and truck repairs on the main line elevated cars are performed at the Sullivan Square shops in Charlestown. Here, after trucks are removed from the car, they are run under an air hoist and the truck frame is lifted off the wheels and axles. While the truck frame is in the air, the under side and parts which are usually difficult to see are carefully examined. To some extent this inspection requires that the men be underneath the trucks. In order to afford greater safety, chains have been installed for the purpose of holding these trucks while the men work beneath them. Thus, even were something to happen to the air hoists, the trucks could not fall on the men underneath. This feature is shown in the photograph reproduced on page 122.

At this shop a motor stand case was installed in order to permit mechanics when replacing field coils to turn cases without danger to themselves. It was formerly the practice to change wheels and motors with the trucks over the pit. To eliminate the possibility of accident to the men working in the pit, the practice has been changed and all wheel and motor work is done on the floor of the shops. Illustrations are given to show the contrast between the two methods.

Steel hinged supports for car body.

Formerly when cars were brought in for repairs to the trucks, it was the practice, in order to remove the trucks, to raise the car



Showing Advantage of Depressed Pit with Leg Holes for Inspection and Repair Work on Trucks and Motors

body and support one end by a beam resting on two horses, one on each side of the track. The beams were 10 x 10 inch heavy timber and the men were likely to strain their backs in lifting them. Steel supports have now been installed which are swung under each side of the car, thus eliminating the horses and beams and doing away with heavy lifting. These supports are permanently fixed in place and are, therefore, safer. They are shown in one of the illustrations.

Safeguarding movement of third rail trains in shops.

In moving third rail cars from point to point in the shops where only overhead trolley wires are provided, it has been customary to supply these cars with current from carriages running on the trolley wires. The trailing wire was covered at the bottom end by a wooden sleeve inside of which was a copper terminal. This terminal could be pushed out and held against the third rail contact shoe. Now the trolley wire has been replaced by angle iron and the sleeve at the bottom of the wire has been replaced by a device which clamps on to the third rail contact shoe. The dangers of personal contacts with the live terminal and of employees being struck by the carriage coming off the wire have been eliminated by the present method.

Other safety and health features in shops.

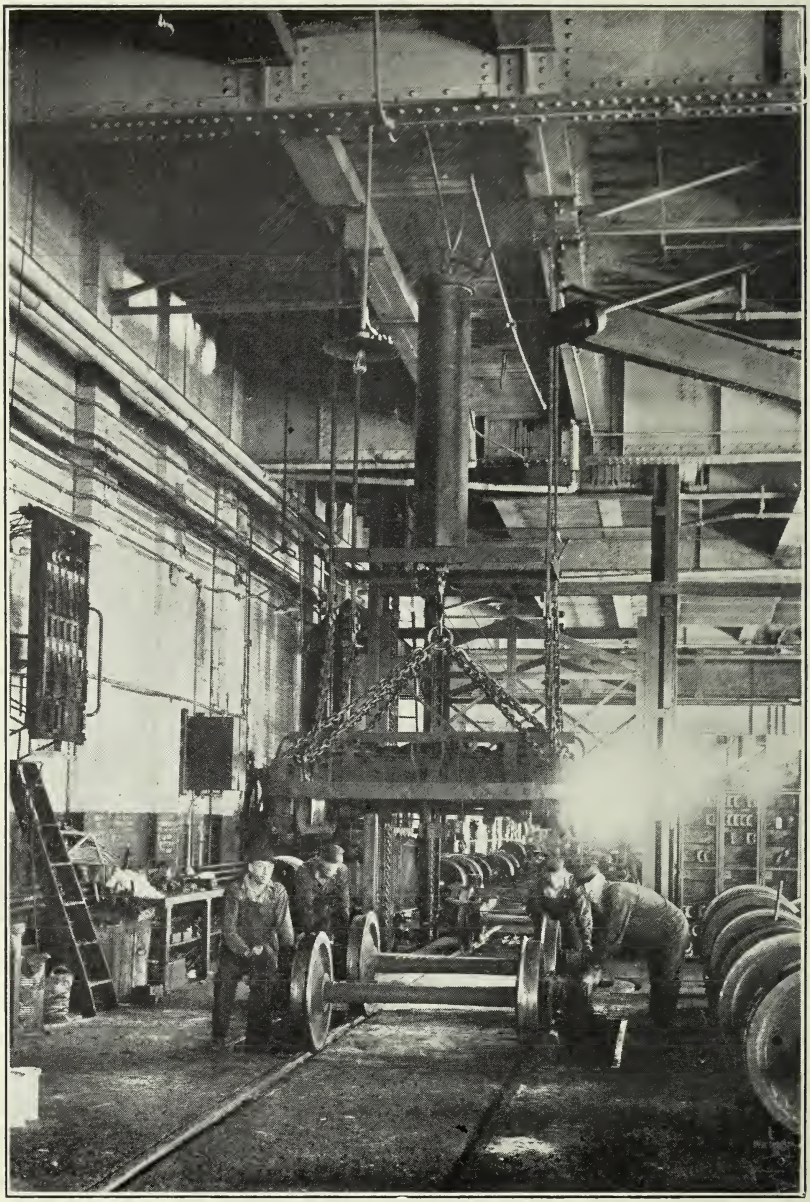
Other examples of ways in which the Railway is protecting the health and safety of employees in car shops are briefly described in the following paragraphs.

Latest type of machinery and tools.

The Railway is constantly replacing antiquated machine tools with those of late types. Thus in one shop during 1928 there were installed an engine lathe, a radial drill and a power hack saw. To eliminate the danger from overhead belts, most of the machines are individually driven. Home made tools have been discarded in favor of standardized equipment.

Exhaust fan to remove gases.

A babbitting furnace is located in the machine shop at Sullivan Square. This furnace, which consists of two pots holding several hundred pounds of babbitt metal each, is gas fired. Over this furnace is a hood connected to a stack which is designed to carry off the products of combustion and fumes from the babbitt pots. Under certain conditions these gases were not all carried off. An exhaust



Safety Chains on Pneumatic Hoist, Safeguarding Men Working Underneath

fan has been installed therefore, which insures that all of these gases will be carried off into the stack and that none of them get out into the shop.

Exhaust fan to remove dust.

Similarly, at the Eliot Square shops an exhaust fan was installed to remove dust from the air when the motors are being blown out.

Tables at proper height.

For men engaged in overhauling, tables are provided to support motors at convenient height. Thus, they are not required to bend in fatiguing positions.

Safety guards and signs.

To reduce accidents to men employed in repair shops, doorways leading from the shops to the operating tracks are guarded by means of railings. The railings are so placed that employees must turn to face approaching cars before crossing the track. Signs have been posted requiring cars to come to a stop before crossing walks which extend across car houses and shops at right angles with the track. Signs have been placed also over all doors leading from one section of a building to another section where the passage is across tracks.

Safety stops on hoists.

In the shops, safety stops have been placed on Shepard hoists to prevent them from swinging around when not in use.

Improved emery wheel guards.

In all shops emery wheel guards have been improved and additional pairs of glasses are kept nearby.

Garages

In keeping its bus garages safe for the employees, the Railway makes use of the best available methods. This is possible because the garages have been constructed in accordance with the same standards that govern in car house construction.

Of the five bus garages owned (the latest opened in 1928), having a total capacity of 327 buses, all, except the original remodeled power station holding 13 buses, are entirely new.

Refueling Buses Out of Doors Through Special Hose Nozzle

It is doubtful if many other railway properties have garages which will compare with those of this railway from the viewpoints of arrangement, cleanliness, ventilation, lighting (both natural and artificial), sanitation and all other features which contribute to the safety and welfare of employees. The excellence of the bus garages can be attributed, to a very large extent, to the study given to the preliminary planning of the buildings and to the careful following up of all details pertaining to safety.

Construction of non-combustible material.

The garages are constructed of non-combustible material throughout and are provided with all modern means of protection against fire.

Clear floor areas.

The floor areas are clear, without posts, thus minimizing accident risks from collisions. The large floor area eliminates practically all backing of buses within the garage, thus doing away with a common accident hazard.

Ample light.

The floors are lighted by means of large area windows and skylights. Each floor area of 20,000 square feet has approximately 6,267 square feet of window area.

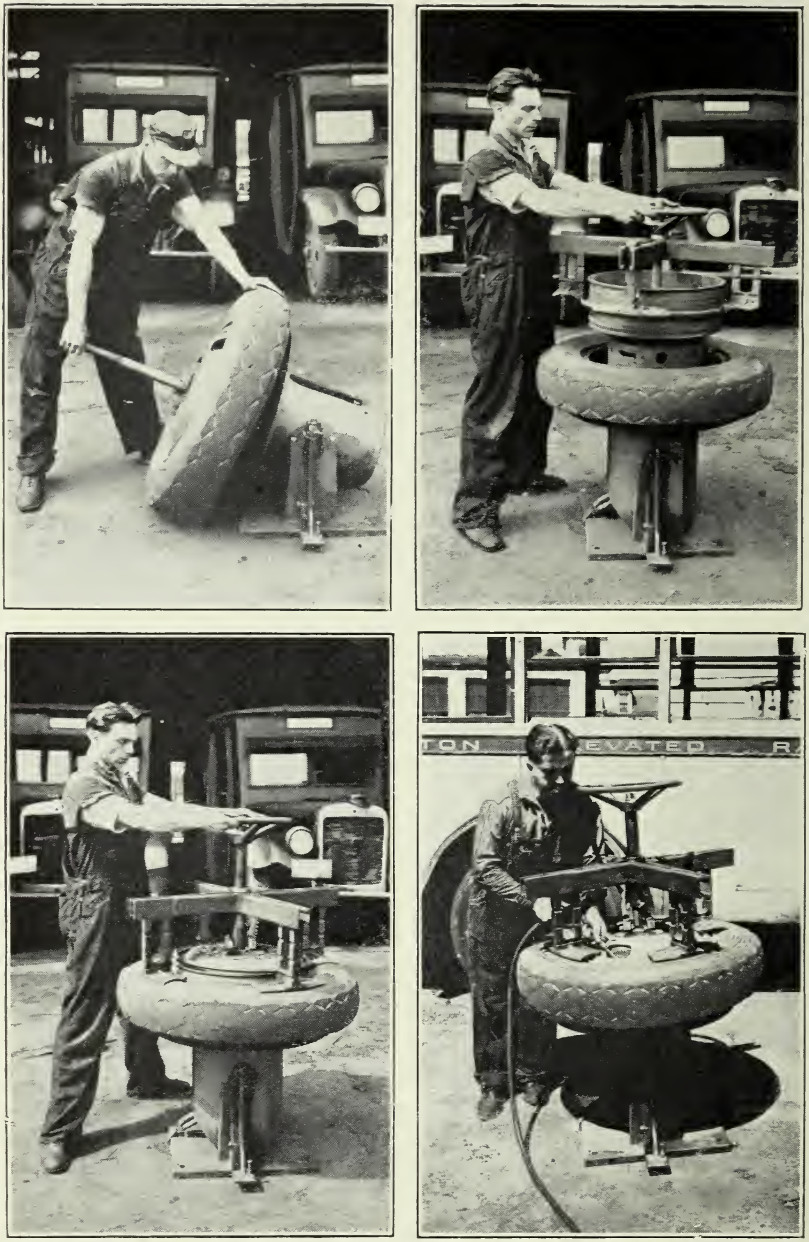
Ample fresh air.

Fresh air is admitted to the garages by means of open windows and fresh air registers at floor level. The foul air is removed by means of large revolving ventilators on the skylights. At times of maximum movement of buses, additional ventilation is available through large doorways.

Work can be done underneath buses in drop-pit repair sections into which sufficient fresh air is admitted by means of openings at pit floor level. Foul air is removed from these repair sections by means of ducts connected with revolving ventilators above the roof. When bus motors are operated in repair pits a connection is made to an exhaust duct having a revolving ventilator above the roof.

Other safety details in construction and layout.

Location of entrance and exit doors to permit free movement of buses in and out.



Machine for Changing Bus Tires

Location of pits to avoid danger of persons and buses falling into them.

Location of all filling pumps and tanks for gasoline away from the garage buildings.

Isolation of the heating plants from the main garage.

Safety equipment and methods in bus garages.

Employees have been protected in garages by means of special equipment and practices, several of which are described below.

Safer overhauling of motors.

Bus motors in need of overhauling are taken from the bus to the motor room by means of electric hoists operating on overhead telpher beams. The motors are lowered on to especially designed motor stands which permit the tilting and turning of motors to any position during overhauling work. Numerous accidents which would result from handling motors on the floor are thus avoided. Unnecessarily heavy labor is also eliminated by reason of the hoists and motor stands.

Automatic shut-off nozzle.

Gasoline was formerly fed to the buses at the garages through the ordinary hose and nozzle. To render this operation safer as well as less wasteful, an automatic shut-off nozzle was devised and is now in general use. The ground around the gasoline pump is now always dry and the fire hazard is therefore much less.

Tire changing machine.

The old method of changing tires by means of a sledge hammer involved difficult and dangerous work in addition to liability of damage to the tires. An employee of the Railway invented a tire-changing machine (illustrated in accompanying photographs) with the aid of which the tire can be pressed on and off the rim with ease. All Boston Elevated garages are now equipped with this machine. The machine tilts to receive the heavy tire equipment, eliminating heavy lifting.

Heavier jacks and safer use of jacks.

All small and light jacks in the garages of the Railway have been replaced by 7½-ton jacks. When a bus is jacked, the jack is reinforced with blocking before an employee is allowed to get under

the bus. This procedure is to avoid injury from the slipping of jacks.

Safe way of applying chains.

Formerly dual skid chains were applied in winter to the rear wheels of buses. This necessitated the jacking of the rear of the bus. Single chains are now applied to the outside rear wheels without jacking. A special block with grooves into which the tire fits is so placed that a bus can be backed on to it in such a manner that the inside dual wheels settle in the concave grooves. The outside dual wheels are thus clear of the ground and are in a convenient position to apply chains.

Accident Prevention in the Maintenance Department

Persistent attention to all branches of accident prevention has reduced the ratio of accidents to employees in the maintenance department from one in 32 during 1927 to one in 34 during 1928, and to one in 41 during the period of eight months ending August 31, 1929. To illustrate the Railway's work in reducing industrial accidents, the equipment and methods used in the maintenance department will be described below.

Modern machinery for track rebuilding.

The use of modern machinery for track rebuilding has resulted in a substantial reduction in accidents to employees who were formerly obliged to handle heavy materials by hand. These machines, in fact, have reduced manual labor materially, thus decreasing the chance of accidents to employees. Moreover, the type of machinery in use, equipped with modern safety appliances, has lessened the possibility of accidents to employees. Following are brief descriptions of accident prevention and labor saving machinery used in track rebuilding and for other purposes in the maintenance department.

Pavement plows.

The Railway uses a pavement plow to break out block pavement. This plow does the work of a good sized crew of men who formerly were liable to accidents by the use of crowbars and other hand tools in breaking out the pavement.

Pavement breakers.

Two Clark pavement breakers and 40 pneumatic concrete breakers to break grouted pavement and concrete base have practically eliminated the danger to employees who formerly did this work by means of sledge hammers and bull punches.

Crane cars.

The Railway has three crane cars to rip up old track and to handle heavy material, including special work. These crane cars are also used in the replacement of tracks and special work. By reason of the operations now performed by the crane cars, the use of jacks, bars, hammers, chisels, etc., in this type of work has been materially reduced, thus lessening the chance of injury to employees.

Machinery for handling concreting material.

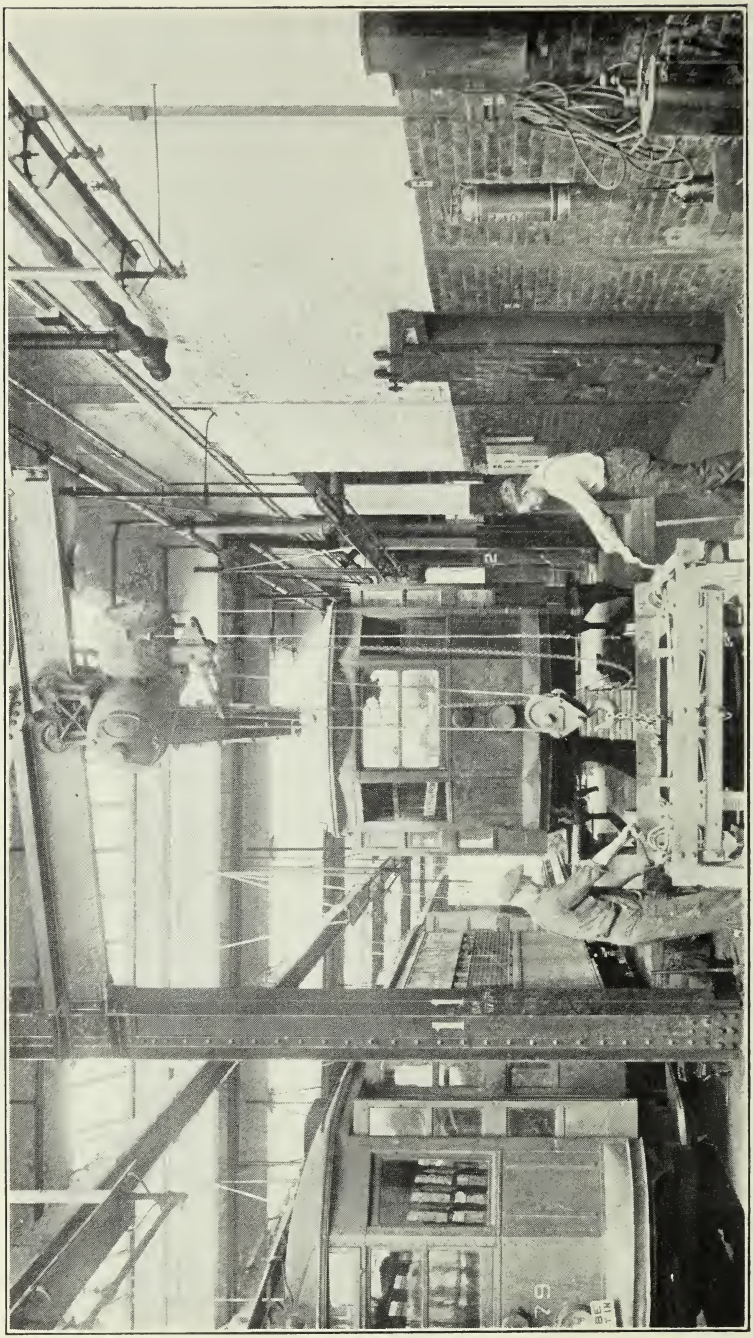
The Railway has nine concrete mixers of various types. It has also three conveyors which can be attached to certain mixers, thus eliminating in those cases the necessity of conveying the materials to the mixer by means of wheelbarrows.

Steel hopper cars with center dump bottoms.

For the laying of stone ballast, the maintenance department employs three steel hopper cars with dump bottoms open in the center, allowing the ballast to fall directly on the track bed. Formerly side dump cars were used. By dumping the stone ballast directly on the track bed, the accident hazard from stone ballast flying to one side and striking employees has been eliminated. The additional accident hazard to employees from ballast lying on the side of the street in the way of their work has also been eliminated by the new type of dump car.

Electric shovels.

The Railway introduced dual traction for its electric shovels. These shovels are equipped with both car wheels and caterpillar treads so that they can be operated either on rails or on the ground. By the use of the caterpillar treads, these shovels, of which the Railway has two, have eliminated the heavy work and hazard involved in moving short sections of temporary track from the rear to the front of the shovels as they proceed along the trench. The hazard to employees from the swinging of the boom attached to



Car Body Raised on Body Hoist—Truck Run Out to a Position Under Jib Crane

the shovels has been reduced because the boom now swings over an arc of not more than thirty degrees, whereas formerly it traveled over an arc of one hundred and eighty degrees. The operators of the shovels, moreover, are watchful at all times to protect workmen from the swinging of the boom.

Hoists on motor trucks.

Four motor trucks equipped with hoists are used for loading, unloading and transporting heavy track machinery, thus saving unnecessarily arduous labor. Formerly the heavy machines were rolled on and off team-drawn trucks by means of skids.

Hoists on rail cars.

Rail cars equipped with hoists haul all rails, castings and other heavy materials, to and from the jobs, thus eliminating heavy labor. The Railway has three such rail cars.

New and safe method of grinding track.

Formerly corrugation was removed by means of portable grinding equipment. The use of this equipment was hazardous because the men were subject to accidents from vehicular traffic while grinding the track. Accidents to men from this source were numerous. Within the last two years the Railway has developed a type of car in which grinding operations are controlled wholly within the car. The car is operated in the daytime during non-peak hours of travel. The accidents to employees from exposure to traffic have been eliminated. In the use of the portable grinding equipment, employees were also subject to accidents by reason of proximity to the apparatus. This element of risk has been eliminated since the advent of the grinding car, three of which are used by the Railway.

Traveling cranes in rail shops.

In shops, traveling overhead cranes convey rails from one machine to another for whatever work needs to be done on them, thus eliminating accidents resulting from the manual carrying of rails.

Use of acetylene torches.

All cutting of rails is done by means of acetylene torches in so far as possible. Cutting of rails by means of chisels or saws, for-

To All "El" Employees

IT is appropriate that the message to you this month should relate to accident prevention. Its purpose is to request your sustained co-operation in the systematic effort which is being made to assist you in making the Railway increasingly safer. Travel on the streets is becoming potentially more dangerous. By that I mean that the chance of accident is greater as the street congestion increases. We must cope with the situation.

Every man naturally abhors being involved in an accident. The bravest man shrinks instinctively from causing suffering, and to a lesser extent he dislikes being the cause of damage to property. This is what makes a man inherently a safe operator, or whatever else his task may be. All accidents are, therefore, inadvertent, that is, unintentional.

At the same time a man who is always fearful of causing an accident is not in a safe state of mind. Self-confidence in one's ability to avoid accidents, of course backed up with real skill, is the best safeguard.

It is better to concentrate on safety than on accidents.

Edward Dana

merly a common source of accidents, has been reduced to a minimum.

Supervisor of accident prevention.

By reason of the nature of the work of the maintenance department, which has supervision over track structure, buildings, subways, elevated structures. signals, etc., it was deemed expedient to have a supervisor of industrial accidents to devote his entire time to accident prevention.

Workmen's safety committee.

In the maintenance department each accident is analyzed by a committee known as the Workmen's Safety Committee. The committee comprises the division head or his representative, the accident supervisor, the foreman on the job and the injured employee. Suitable steps are taken to prevent, if possible, the recurrence of any accidents.

Controlling accidents.

The supervisor of industrial accidents lists the following as some of the more important factors now in effect for the control of accidents in the maintenance department:

1. Careful instruction of new men unfamiliar with the work they are to do. New men are impressed with the necessity of looking out for their own personal safety and for that of their fellow workmen. The hazards of the employment and the precautions to be taken are carefully explained.

2. Attention to minor injuries to minimize the chance of their becoming serious. First aid kits have been installed for immediate treatment. In cases of minor injuries, so-called, men are required, in the event of any chance of serious consequences, to see the nurse.

3. Elimination of defective tools.

4. Care in placing materials in streets in order to reduce risks from improper piling. Moreover, materials are placed where and at the time when they are needed. This eliminates unnecessary hauling. It prevents, also, the creation of accident hazards to employees arising from the interference of the material with regular vehicular traffic.

5. Placing of conspicuous signs near street work to warn drivers of the presence of workmen.

6. Protection of workmen from burns in welding and in pouring spelter.

7. Supplying of "white cross" belts studded with red disks to track cleaners and others exposed to street traffic except the regular gangs doing street work.

8. Special attention to the condition and use of ladders.

9. Placing of guards on dangerous parts of mill machinery.

10. Insistence upon the wearing of goggles in grinding.

11. Instruction in first aid.

12. Use of cotton gloves, supplied at the expense of the Railway, by all workmen obliged to handle creosoted timber.

13. Observance of a set of rules governing the safety of employees of the maintenance department engaged on elevated structures and in the subways and tunnel.

Miscellaneous Measures for Employee Safety

Among the many ways in which work in the various departments has been made safer for the employees, a few outstanding examples may be cited.

Improved pit lighting.

The illumination of station pits has been improved to safeguard employees working in or around them.

Testing car roofs.

The Railway makes periodic tests of car roofs for grounds to prevent electric shock to men working on the roofs.

Separating high voltage from battery fuses.

Sixty of the Railway's Cambridge subway cars are equipped with an overhead fuse panel in which are located a number of 600-volt fuses and also a number of battery fuses. The spacing of the fuses on this panel was such that with ordinary care there was no danger of bridging between the 600-volt and the battery potentials in the replacement of fuses. To eliminate, however, the possibility of shock or burn, transite board barriers have been installed, separating the two types of fuses. The barriers project several inches from the face of the fuse panel.

Plank walks.

At yards on rapid transit lines where the track is built in ballast or in concrete, plank walks have been installed between the tracks to reduce the liability of a yardman receiving a shock when coupling or uncoupling cars.

Fibre dust pans and pails.

Metal dust pans were used formerly by station porters. On account of risk of contact with the third rail, the use of such pans is now forbidden. Especially designed fibre dust pans have been provided for this purpose. The Railway also substituted fibre for metal pails as containers for water and sand.

Safe adjustment of wings on snow plows.

On the old type of snow plows used by the Railway there was a hazard because wings were adjusted by hand. On the latest plows, men are not required to leave the plow to adjust the wings. Adjustment is by means of compressed air.

"Grab" handles for safety.

Iron "grab" handles have been fastened to the outside of elevated cars near the door to permit yardmen to board these cars safely.

Sun visors on buses.

Sun visors have been placed on buses to prevent glare in the eyes of the driver.

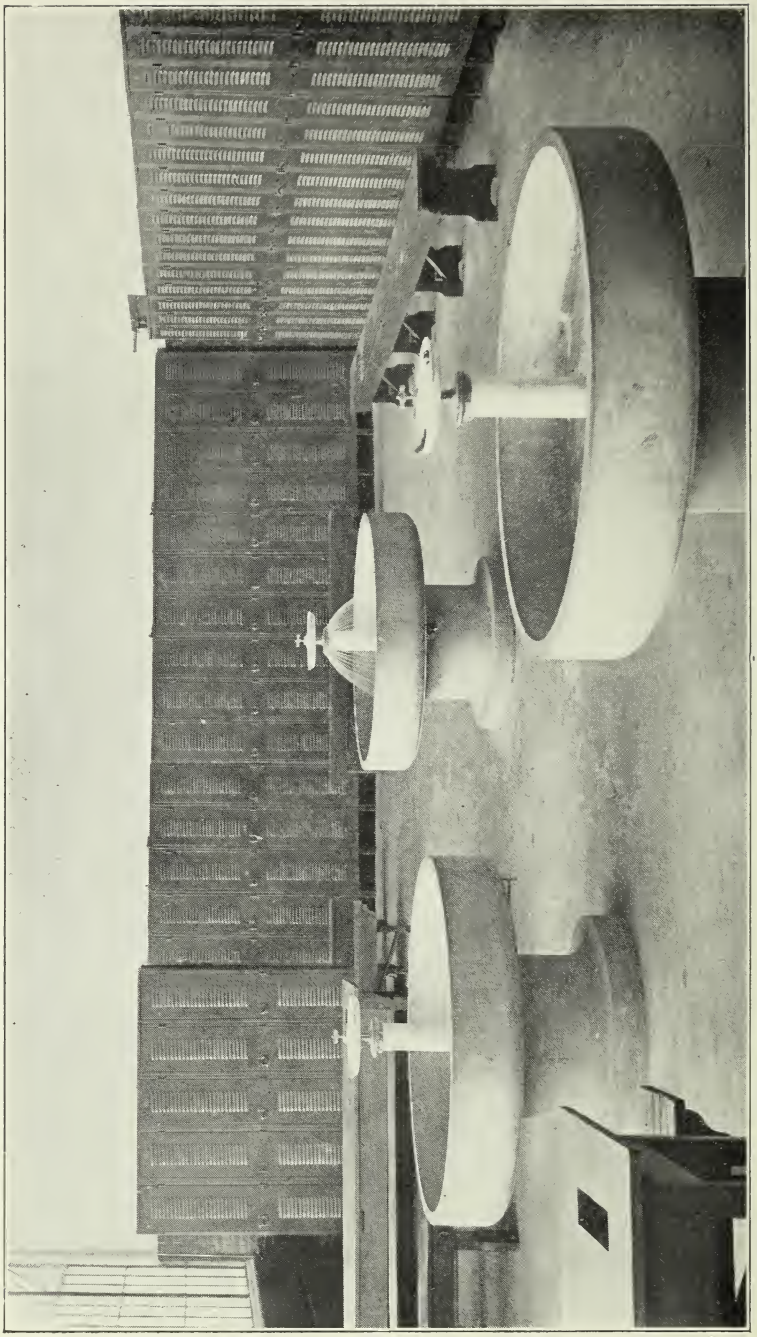
Employees barred from crossing tracks at danger points.

In order that employees cross tracks at points where approaching cars or trains can be seen, fences with warning signs have been constructed at points where the view of approaching cars or trains is obstructed.

Outstanding Measures in Sanitation and Health

Thorough physical examination.

In addition to physical examinations at time of employment, all transportation employees connected with car movement are re-examined annually after they have reached the age of 40. Special attention is given to eyesight, blood pressure, etc. Through these



Repairmen's Locker and Wash Room Showing the Modern Spray Washing Facilities

examinations it is possible to make provision whereby men believed to be susceptible to sudden illness are placed in positions where such illness would not affect the safety of the public or fellow employees.

First aid rooms.

For the immediate care of minor accidents to employees, first aid rooms with attendant nurse are provided at the larger car and shop terminals.

Instruction in first aid.

By arrangement with the Transit Mutual Insurance Company, with which this railway carries on its Workmen's Compensation Insurance, instruction in resuscitation from electric shock and first aid treatment is given to several groups of key men in the several departments.

Adequate lobby and toilet accommodations.

Adequate lobby facilities are provided for the workmen, including proper toilet accommodations and, in many places, showers. Hot water has been provided wherever possible, but particularly in shops and yards.

Water coolers.

Bubbling fountain water coolers for trainmen and others have been placed in the more important lobbies, yards and stations, thus doing away with unsanitary and miscellaneous cups.

Abolition of common towel menace.

The menace of the common towel has been abolished. Paper towels have been provided in many locations.

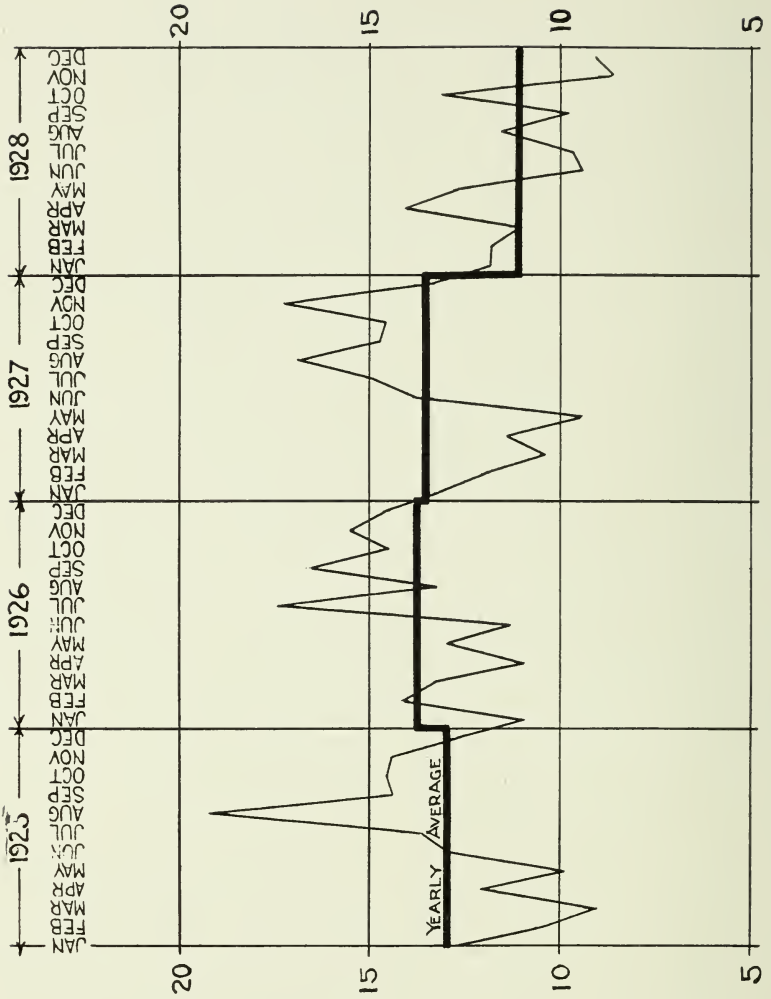
Inspection of lockers.

In the car houses, the workmen's lockers are periodically inspected by the foremen in the presence of the users in order to insure a high standard of cleanliness.

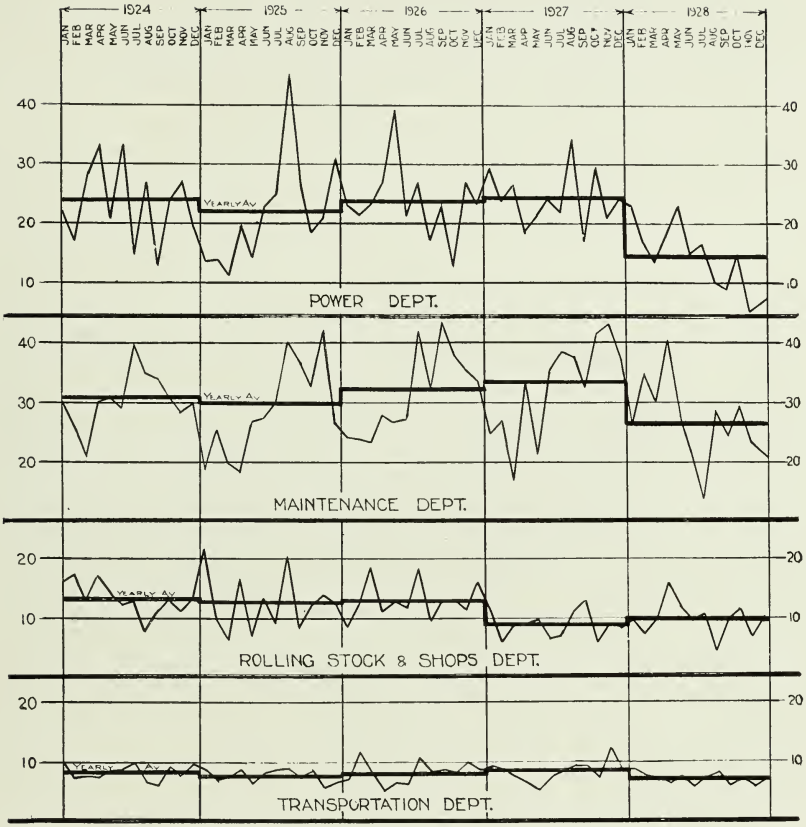
Fire Prevention Methods

Reducing fire hazard.

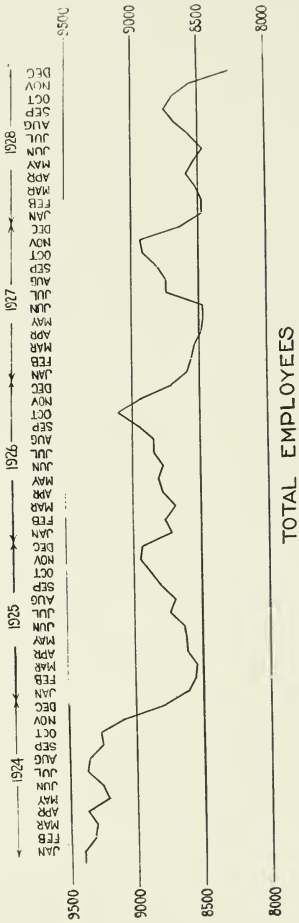
Many of the old wooden car houses have been torn down and modern fireproof units erected. Such old wooden car houses as are

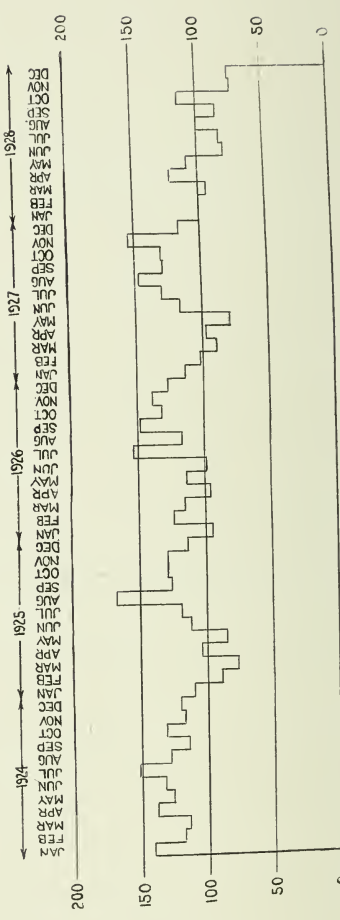


TOTAL AVERAGE OF ALL DEPARTMENTS
NUMBER OF INDUSTRIAL ACCIDENTS PER 1000 EMPLOYEES



NUMBER OF INDUSTRIAL ACCIDENTS PER 1000 EMPLOYEES


TOTAL EMPLOYEES
9500
9000
8500
8000
1924
1925
1926
1927
1928
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN


TOTAL INDUSTRIAL ACCIDENTS
200
150
100
50
0
1924
1925
1926
1927
1928
JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN

in service have been reduced in area as far as possible with the view of reducing the fire risk. In the wooden car houses as well as the modern car houses, sprinkler systems have been installed and fire extinguishers, hose, sand pails, etc., are supplied. Auxiliary fire alarm boxes are installed at suitable locations connected with the city fire alarm system. All buildings are under constant supervision to prevent fire. When a fire occurs, even of a very minor nature, an inspection is immediately made by representatives of all departments concerned to ascertain the cause and, if possible, remove the hazard.

All third-rail trains and rapid transit stations are equipped with fire extinguishers. Stations are equipped also with fire hose. Between stations, pails filled with sand are placed at frequent intervals. All this apparatus is frequently inspected to see that it is in usable condition.

Training in use of fire apparatus.

At each car house, shop, power station and yard, crews of men are organized for both day and night service and are trained in the use of fire apparatus under the direction of competent foremen. In co-operation with the Boston Board of Fire Underwriters drills are held unexpectedly at least twice a year. The reports received from the Boston Board of Fire Underwriters with respect to the success of these day and night drills during 1928 were very favorable.

Statistical Summary of Reduction in Industrial Accidents

The policy of embracing, just as soon as it was presented, each opportunity for increased safety of employees by the immediate adoption of sane, reliable and unannoying methods, rather than by sporadic or spectacular efforts, has resulted in tangible improvements, the cumulative results of which are decidedly satisfactory.

Reduced frequency.

The chart which is reproduced on page 138 shows the number of industrial accidents from 1925 to 1928, inclusive, per 1,000 employees combined for the four major departments of the Railway,—power, maintenance, rolling stock and shops and transportation.

The yearly average on this chart shows a 20 per cent reduction in frequency of accidents in 1928 compared to 1927.

Similarly, the second chart, which is reproduced on page 139, shows the number of industrial accidents from 1924 to 1928, inclu-

sive, segregated for the four major departments. Although there are seasonal fluctuations and peaks in all these departmental charts, these changes are accounted for by the varying nature of the work undertaken and by the conditions of the weather.

The accidents in all departments in 1928 show a substantial reduction compared to previous years.

Lessened severity.

No exact numerical criterion is available to indicate the effect of the safety work upon the severity of accidents, but the figures showing the cost of industrial accidents may safely be taken as indicating the trend of severity.

The following figures show the cost of industrial accidents per $100 payroll in the four major departments for the years 1927 and 1928:

Cost of Industrial Accidents per $100 of Payroll

	1927	1928
Power	$1.932	$0.929
Maintenance	1.498	.824
Rolling Stock and Shops	.312	.362
Transportation	.238	.207
Weighted average for all departments	.591	.393

From these figures it will be seen that the weighted average in 1928 compared to 1927 was reduced from 59 cents to 39 cents per $100 payroll. This is a reduction in cost of 33 per cent.

Conclusion.

These figures show a reduction of 20 per cent in frequency and of 33 per cent in cost, indicating clearly that the frequency and the severity of accidents has been very much lessened in 1928 compared to 1927.

These very creditable results are partly to be accounted for by the excellent organization, co-operation and active interest in safety of the employees in the various departments, and partly by the close co-operation on the part of heads of departments and the insurance company which carries the Railway's workmen's compensation insurance.

PART VI

Statistical Summary of Accomplishments

PART VI

Statistical Summary of Accomplishments

The preceding material has set forth in considerable detail the efforts of the management and employees of the Boston Elevated Railway in accident prevention. Success in accident prevention can best be shown in a statistical summary. The figures bearing on the fruits of the Railway's work have been gathered together in this last section.

The following figures show surface car and rapid transit accidents in 1928, 1927, and 1926:

Year	1928	1927	1926
Accidents	16,886	18,255	20,798

These figures show a reduction of 1,369 in surface car and rapid transit accidents in 1928 compared to 1927, and of 3,912 in 1928 compared to 1926.

The bus accidents in 1928, 1927, and 1926 are shown by the following figures:

Year	1928	1927	1926
Accidents	1,842	2,101	2,335

Thus, in 1928 compared to 1927 there was a reduction of 259 bus accidents, and last year compared to 1926 there was a reduction of 493 bus accidents.

It will be seen from these figures that the results obtained in 1928 are not the result of an isolated year's effort but an accelerated reduction in a steadily improving situation. Figures in the tabulation show that the reduction in accidents is not due to a reduction in mileage operated.

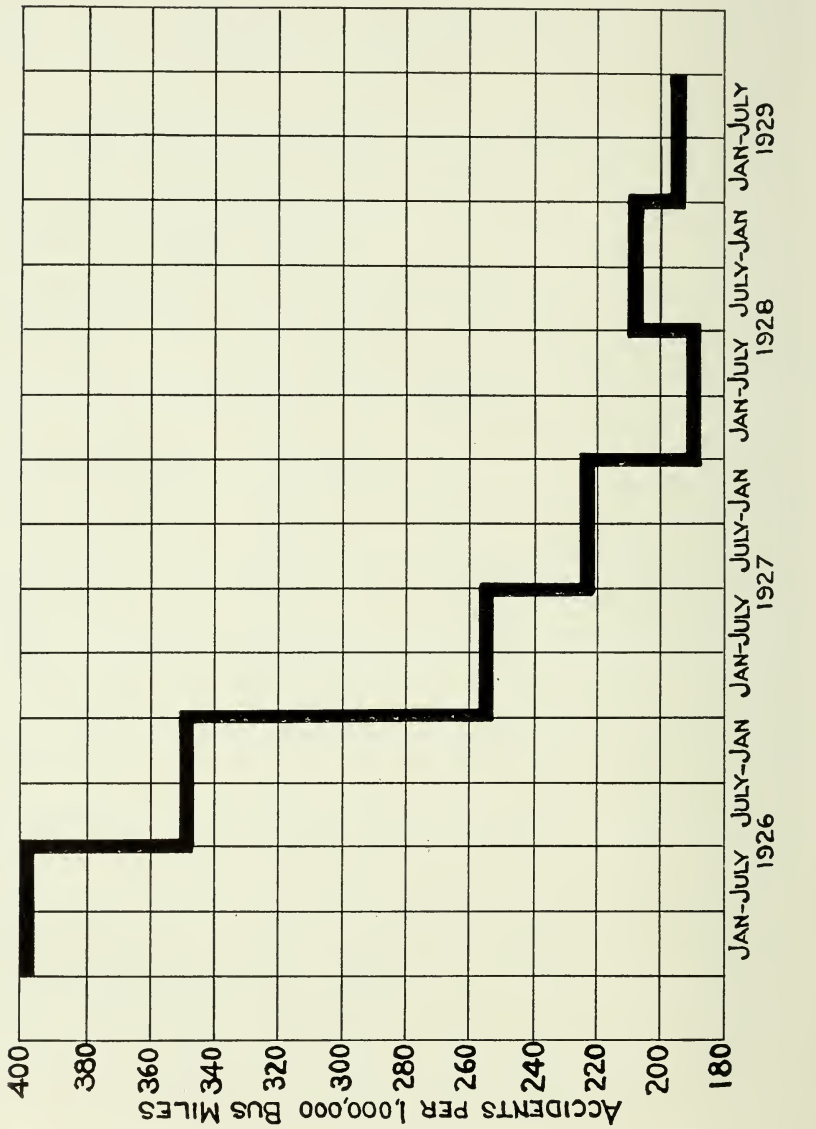
The charts on pages 146, 148 and 150 show the reductions in selected surface car, bus and rapid transit accidents on a car mile basis.

Selected classes of accidents have been used in these charts. During the year culminating in 1927, the cost of accidents was increasing alarmingly. The realization of this fact and its consequences led to a review of the situation in the latter part of 1927. That review led to the belief that not only must the rate of accident

*The data furnished to the award committee will be found at the end of this section beginning at page 151.

Bus Accidents

Collisions with Vehicles, Cars and Persons, and Boarding and Alighting Accidents



reduction in general be accelerated but that skilled effort should first be devoted to the most costly classes of accidents. These costly accidents and the success attained in reducing their number are therefore selected for special mention in this report.

That this concentration of effort on special classes of accidents (which accounts for 88% of injuries and damages costs) has been successful is shown by the fact that in the reduction last year compared to 1927 of 1,369 surface car and rapid transit accidents, the reduction in collisions alone was 1,278, and of the reduction of 259 bus accidents the reduction in collisions alone was 238.

The chart on page 154 shows graphically the reduction in different classes of surface accidents.

Trend of Accident Costs

The seriousness of the situation from the point of view of claims and the extent to which accident reduction, as illustrated by the 1928 result, can affect this claims situation is illustrated in the chart on page 160.

Graph 3A shows that the average cost of claims settled without court procedures has been increasing. Graph 3B shows a similar but much larger increase per suit for the cases which have gone to Superior Court. Rates of increase shown in these charts, particularly in 3B, were so great as to warrant and even necessitate very great insistence on accident reduction.

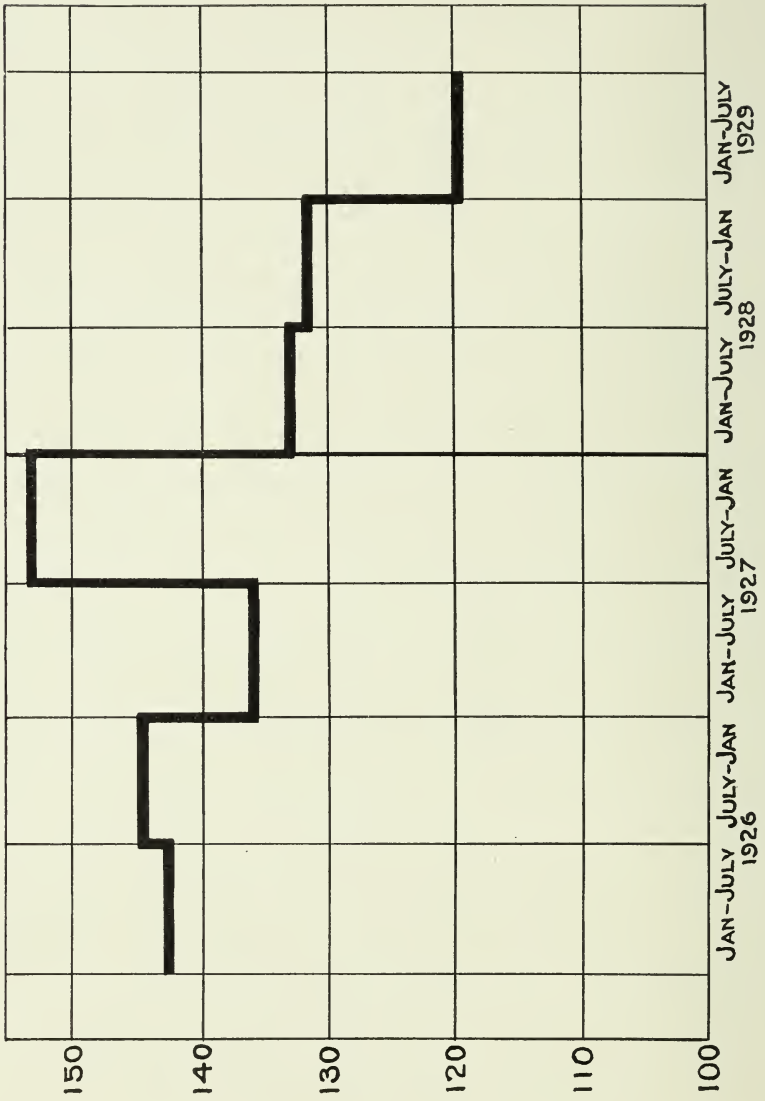
Moreover, the percentage of reports which result in claims had been steadily increasing up to 1927, as is shown by Graph 3C. The upward trend of this line was reversed in 1928 for the first time in seven years. This reduction in 1928 was presumably because the reduction in accidents which was effected was chiefly among that class of accidents which, if they had occurred, would have involved claims.

Graph 3D shows that the number of claims made on account of accidents had been steadily increasing up to the beginning of 1927. A small reduction took place that year, but in 1928 the accidents were reduced to such an extent that the claims were 1,030 fewer than in the previous year and the number was brought lower than at any time during the previous five years.

The cost of injuries and damages in 1928 increased approximately $100,000, or 8% over 1927. This increase was due partly to

Rapid Transit Accidents

Persons Falling in Trains and in Stations, and Door Accidents on Trains



the lag in payment of claims and partly to the fact that there were 118 more Superior Court suits pending during 1928.

Many of these were on account of accidents occurring in previous years but which had not been disposed of because of congestion in the courts. These 118 suits (at over $800 each) required increasing the reserve account by approximately $100,000 (the difference between $250,571.39 and $346,908.54).

Owing to the time necessary for the filing and disposing of claims a decrease in accident costs cannot be expected to take place in the same year as that in which a decrease in accidents is effected. Some reduction should, however, show in the following year and also in subsequent years.

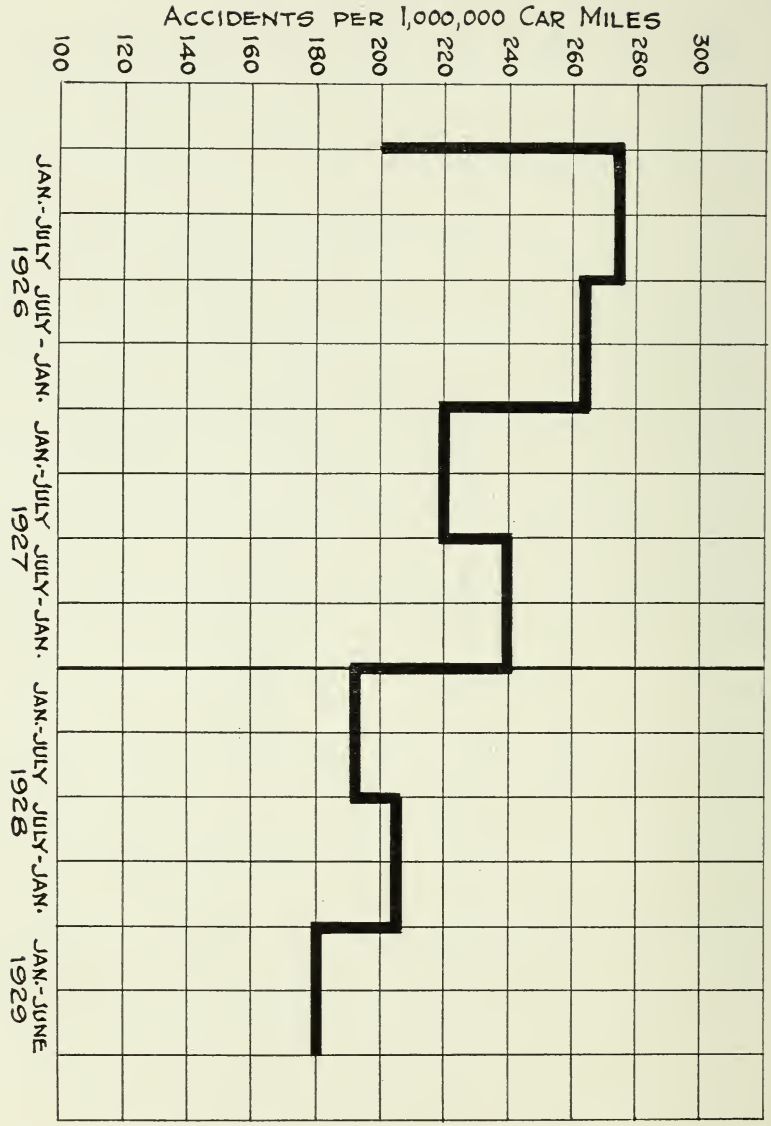
Actual Reduction in Cost of Injuries and Damages

In the period January 1 to August 31, 1929, the total cost of injuries and damage has been approximately $164,000 less than in 1928. The reduction of $164,000 is accounted for by a reduction of $110,000 in the amount actually paid for injuries and damages; a reduction of $24,000 in the reserve set aside for suits brought in the Superior Court, and a reduction of $30,000 in legal department expenses.

These figures prove conclusively that the entire accident reduction program of 1928 was effectively carried out and produced the desired result:—namely, a numerical reduction in the expensive classes of accidents and a substantial saving therefrom.

Street Car Accidents

Collisions with Vehicles, Cars and Persons, and Boarding and Alighting Accidents



AMERICAN ELECTRIC RAILWAY ASSOCIATION

292 Madison Avenue,
New York, N. Y.

Data Sheet No. 360

ELECTRIC RAILWAY ACCIDENT STATISTICS

Name of Company: *Boston Elevated Railway*

City: *Boston* State: *Massachusetts*

NOTE: Bus accidents should not be included unless it is impossible to segregate them. Report bus accidents separately on D. S. 361 attached hereto.

ANALYSIS OF ACCIDENTS

	1928	1927
1. TOTAL NUMBER OF ACCIDENTS	16,886	18,255
(a) Collisions with Motor Vehicles	5,348	6,397
(b) Collisions with Cars	144	205
(c) Collisions with Other Vehicles on Street	185	313
(d) Collisions at Railroad Crossings	0	0
(e) Collisions with Pedestrians	246	286
(f) Boarding and Alighting	997	1,114
(g) Derailments	209	243
(h) Accidents on Cars (not in collision)	2,272	2,395
(i) All Other Accidents	7,485	7,302

INJURIES AND FATALITIES

2. NUMBER OF ACCIDENTS RESULTING IN PERSONAL INJURIES	(See Footnote)	
3. TOTAL NUMBER OF PERSONS INJURED	5,191	5,972
(a) Passengers (who made claims)	2,713	2,514
(b) Employes	1,076	1,308
(c) Others (who made claims)	1,402	2,150
4. TOTAL NUMBER OF FATALITIES	31	35
(a) Passengers	9	9
(b) Employes	3	10
(c) Others	19	16

NOTE: Unable to determine; all injured do not present claims.

ACCIDENTS TO EMPLOYES 1928

NOTE: Please indicate whether or not any of the accidents reported below are included in the answers to questions 1 to 4 above. If so, please indicate where they are included, as li, 4b, etc. Yes, 3b and 4b.

Department	Man Hours Worked	Number of Accidents	No. of Employes Injured	Time Lost (Days)	No. of Employes Killed
R. S. & S.	No record.	166	166	2,749	0
Power		102	101	1,762	1
Maintenance ...		437	435	5,159	2
Transportation ..		369	369	3,441	0
Office		5	5	41	0
TOTAL		1,079	1,076	13,152	3

ACCIDENTS TO EMPLOYES 1927

Department	Man Hours Worked	Number of Accidents	No. of Employes Injured	Time Lost (Days)	No. of Employes Killed
R. S. & S.		146	146	3,134	0
Power		183	180	1,512	3
Maintenance		572	567	4,739	5
Transportation ..		416	414	2,842	2
Miscellaneous ..		1	1		0
TOTAL		1,318	1,308	12,227	10

ANALYSIS OF ACCIDENT COSTS

	1928	1927
5. Total Cost of Injuries and Damages (I. C. C. Account No. 92)	$1,502,313.56	$1,391,017.62
(a) Amount Paid in Settlement of Claims	853,091.46	839,428.61
(1) For Property Damages		
(2) For Personal Injuries	See Footnote "A"	
(b) Cost of Claims Department including Medical Service and Private Investigations	182,573.19	174,095.34
(c) Legal Expenses in Connection with Claims (Not included in b)	81,802,58	91,105,66
(d) Cost of Insurance	None	None
(e) Any Other Expenses (Time of Employees at Claim Dept., Accident Reports, First Aid Rooms, etc.)	37,937.79	35,816.62
(f) Amount charged to this a/c and set up in Reserve	346,908.54	250,571.39
6. What was your cost of safety work, i.e. salaries and expenses of safety department, Safety Council fees, etc., exclusive of safety devices?	$ 25,303.60	$ 13,292.56

STATISTICAL DATA

7. Earnings from all Sources	$32,732,674	$33,252,484
8. Total Number of Car Miles Operated	52,274,776	52,112,218
9. Number of Revenue Passengers Carried	336,794,145	343,490,089

10.	Total Number of Passengers Carried. (See Footnote "B")	604,695,199	615,354,878
11.	Average Total Number of Trainmen	3,612	3,748
12.	Average Number of Cars Operated During Rush-hours	1,905	1,921
13.	Miles of Single Track Operated	489.657	496.010
14.	Miles of Single Track Operated on Private or Restricted Right-of-Way	———	———
15.	Are any Bus Statistics Included in this Questionnaire? Yes, Question No. 5 only.		

Date ..... Signed .....

Title .....

NOTE "A": No division possible as one payment often included both.

NOTE "B": This figure does not include bodily transfer passengers to Rapid Transit lines as they were not included in 1927, 1926 or 1925.

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AMERICAN ELECTRIC RAILWAY ASSOCIATION

292 Madison Avenue,
New York, N. Y.

Data Sheet No. 360

ELECTRIC RAILWAY ACCIDENT STATISTICS

Name of Company: *Boston Elevated Railway*

City: *Boston* State: *Massachusetts*

NOTE: Bus accidents should not be included unless it is impossible to segregate them. Report bus accidents separately on D. S. 361 attached hereto.

ANALYSIS OF ACCIDENTS

		1926	1925
1.	TOTAL NUMBER OF ACCIDENTS	20,462	20,798
	(a) Collisions with Motor Vehicles	7,863	6,646
	(b) Collisions with Cars	258	234
	(c) Collisions with Other Vehicles on Street	490	501
	(d) Collisions at Railroad Crossings	None	None
	(e) Collisions with Pedestrians	363	357
	(f) Boarding and Alighting	1,257	1,348
	(g) Derailments	328	329
	(h) Accidents on Cars (not in collisions)	2,630	2,656
	(i) All Other Accidents	7,273	8,727

REDUCTION IN DIFFERENT CLASSES OF SURFACE ACCIDENTS.

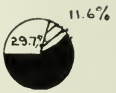
FULL CIRCLE REPRESENTS NUMBER OF ACCIDENTS IN 1927

REDUCTIONS 1928 ▭

REDUCTIONS 1929 ▨

CAR & VEHICLE

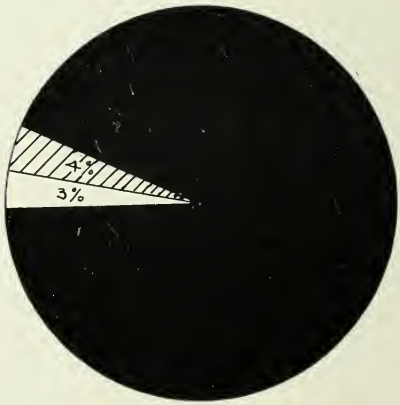
CAR & PERSON



CAR & CAR

DERAILMENTS

BOARDING AND ALIGHTING



MISC. CAR

INJURIES AND FATALITIES

2.	NUMBER OF ACCIDENTS RESULTING IN PERSONAL INJURIES	See Footnote A	
3.	TOTAL NUMBER OF PERSONS INJURED WHO MADE CLAIMS	4,647	3,949
	(a) Passengers (who made claims)	2,722	2,352
	(b) Employes	279	277
	(c) Others (who made claims)	1,646	1,320
4.	TOTAL NUMBER OF FATALITIES	42	38
	(a) Passengers	12	9
	(b) Employes	5	5
	(c) Others	25	24

ACCIDENTS TO EMPLOYES 1926

NOTE: Please indicate whether or not any of the accidents reported below are included in the answers to questions 1 to 4 above. If so, please indicate where they are included, as li, 4b, etc. Yes, 3b and 4b.

Department	Man Hours Worked	Number of Accidents	No. of Employes Injured	Time Lost (Days)	No. of Employes Killed
R. S. & S.	No record kept.	260	260		
Barn				See Footnote B	
Power		174	173	3	1
Maintenance		543	541		2
Transportation		483	481		2
Office		5	5		0
TOTAL		1,465	1,460		5

NOTE "A": Unable to determine. All who are injured do not present claims.

NOTE "B": Figures for these accidents not kept separate. We have a record of days disability on all accidents.

ANALYSIS OF ACCIDENT COSTS

		1926	1925
5.	Total Cost of Injuries and Damages (I. C. C. Account No. 92)	$1,107,063.84	$846,235.82
	(a) Amount Paid in Settlement of Claims	669,166.43	713,849.01
	(1) For Property Damages	No Division made by	
	(2) For Personal Injuries	this Railway	
	(b) Cost of Claims Department including Medical Service and Private Investigations	184,976.14	177,975.93
	(c) Legal Expenses in Connection with Claims (Not included in b)	60,264.35	65,874.85
	(d) Cost of Insurance	None	None
	(e) Any Other Expenses (Time of Employees at Claim Dept., Accident Reports, First Aid Rooms, etc.)	36,823.35	37,385.04

	(f) Amount charged to this a/c and set up in Reserve in excess of actual payment for the period	155,833.57	*148,849.01*
6.	What was your cost of safety work, i.e. salaries and expenses of safety department, Safety Council fees, etc., exclusive of safety devices?	$7,478.75	$10,534.57

(See Footnote)

NOTE: Amount paid in settlement of claims over that which was set up in Reserve and charged to Account No. 92.

STATISTICAL DATA

7.	Earnings from all Sources	$33,910.429.15	$33,678,542.86
8.	Total number of Car Miles Operated	52,796,938	53,085,670
9.	Number of Revenue Passengers Carried	352,233,132	384,082,546
10.	Total Number of Passengers Carried	632,235,984	631,452,323
11.	Average Total Number of Trainmen	3,829	3,870
12.	Average Number of Cars Operated During Rush-hours	1,855	1,866
13.	Miles of Single Track Operated	496.086	504.158
14.	Miles of Single Track Operated on Private or Restricted Right-of-Way	———	———
15.	Are any Bus Statistics Included in this Questionnaire? Yes, Question No. 5 only.		

Date ..... Signed .....

Title .....

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AMERICAN ELECTRIC RAILWAY ASSOCIATION

292 Madison Avenue,
New York, N. Y.

Data Sheet No. 361

MOTOR BUS ACCIDENT STATISTICS

Railway Company: *Boston Elevated Railway*

City: *Boston* State: *Massachusetts*

Operating Bus Company:

ANALYSIS OF ACCIDENTS

		1928	1927
1.	TOTAL NUMBER OF ACCIDENTS	1,842	2,101
	(a) Collisions with Autos or Motor Trucks	978	1,200
	(b) Collisions with Other Buses	19	8

(c) Collisions with Trolley Cars	23	48
(d) Collisions with Other Vehicles on Street	Included in item (a)	
(e) Collisions at Railroad Crossings	0	0
(f) Collisions with Pedestrians	33	37
(g) Boarding and Alighting Accidents	146	134
(h) Accidents within Buses (not due to collisions)	99	91
(i) All Other Accidents	544	583

INJURIES AND FATALITIES

2. NUMBER OF ACCIDENTS RESULTING IN PERSONAL INJURIES	See Footnote	
3. TOTAL NUMBER OF PERSONS INJURED	442	608
(a) Passengers	102	228
(b) Employes	54	85
(c) Others	286	295
4. TOTAL NUMBER OF FATALITIES	0	1
(a) Passengers	0	0
(b) Employes	0	0
(c) Others	0	1

NOTE: Unable to determine; all injured persons do not present claims.

ACCIDENTS TO BUS EMPLOYES 1928

NOTE: Please indicate whether or not any of the accidents reported below are included in the answers to questions 1 to 4 above. If so, please indicate where they are included, as li, 4b, etc. Yes, 3b.

Department	Man Hours Worked	Number of Accidents	No. of Employes Injured	Time Lost (Days)	No. of Employes Killed
R. S. & S.	No record.	32	32	64	0
Transportation		22	22	285	0
Misc.		None	None	None	None
TOTAL		54	54	349	0

ACCIDENTS TO BUS EMPLOYES 1927

NOTE: Please indicate whether or not any of the accidents reported below are included in the answers to questions 1 to 4 above. If so, please indicate where they are included, as li, 4b, etc.

Department	Man Hours Worked	Number of Accidents	No. of Employes Injured	Time Lost (Days)	No. of Employes Killed
Maintenance		None	None	None	None
R. S. & S.		32	32	106	0
Transportation		53	53	461	0
Misc.		None	None	None	None
TOTAL		85	85	567	0

COST OF ACCIDENTS

	1928	1927
5. A.—COST OF INSURANCE:—TOTAL	$ None	$ None
(1) Public Liability Insurance	None	None
(2) Property Damage	None	None
(3) Collision Insurance	None	None
(4) Any Other Accident Insurance	None	None
B—COST OF CLAIMS SETTLED BY COMPANY:—TOTAL	$80,732.30	$74,344.39
(1) For Personal Injuries	See Footnote "A"	
(2) For Property Damage	See Footnote "A"	
(3) Cost of Claims Department including Medical Service, Private Investigations, Legal Expenses in connection with Claims, etc.	See Footnote "B"	
C—ANY OTHER COSTS IN CONNECTION WITH BUS ACCIDENTS—please itemize	See Footnote "B"	

NOTE "A": No division made by this Railway.

NOTE "B": Not segregated as to buses. Included in Question 5 on Data Sheet No. 360.

STATISTICAL DATA

6. TOTAL BUS OPERATING REVENUE	$2,110,474.21	$1,940,926.65
7. TOTAL NUMBER OF BUS MILES OPERATED	6,533,615	6,071,466
8. NUMBER OF REVENUE PASSENGERS CARRIED	25,210,888	23,448,819
9. TOTAL NUMBER OF PASSENGERS CARRIED	42,394,831	39,339,276
10. AVERAGE TOTAL NUMBER OF BUS OPERATORS (INCLUDING CONDUCTORS)	337	304
11. AVERAGE NUMBER OF BUSES OPERATED DURING PEAK SCHEDULE	270	230
12. MILES OF BUS ROUTE OPERATED (ONE-WAY)	75.930	66.39

Date ..... Signed .....

Title .....

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AMERICAN ELECTRIC RAILWAY ASSOCIATION

292 Madison Avenue,
New York, N. Y.

Data Sheet No. 361

MOTOR BUS ACCIDENT STATISTICS

Railway Company: *Boston Elevated Railway*

City: *Boston* State: *Massachusetts*

Operating Bus Company:

ANALYSIS OF ACCIDENTS

	1926	1925
1. TOTAL NUMBER OF ACCIDENTS	2,335	See Footnote "A"
(a) Collisions with Autos or Motor Trucks	1,406	on next page
(b) Collisions with other Buses	16	
(c) Collisions with Trolley Cars	48	
(d) Collisions with Other Vehicles on Street	Included in (a)	
(e) Collisions at Railroad Crossings	None	
(f) Collisions with Pedestrians	51	
(g) Boarding and Alighting Accidents	167	
(h) Injuries within Buses (not due to collisions)	116	
(i) All Other Accidents	531	

INJURIES AND FATALITIES

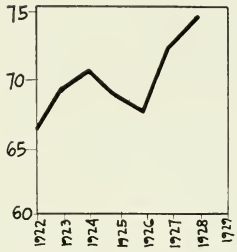
2. NUMBER OF ACCIDENTS RESULTING IN PERSONAL INJURIES		See Footnote "B" on next page
3. TOTAL NUMBER OF PERSONS INJURED		
(a) Passengers		
(b) Employes		
(c) Others		
4. TOTAL NUMBER OF FATALITIES	1	
(a) Passengers	0	
(b) Employes	0	
(c) Others	1	

ACCIDENTS TO BUS EMPLOYES 1926

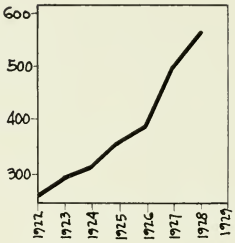
NOTE: Please indicate whether or not any of the accidents reported below are included in the answers to questions 1 to 4 above. If so, please indicate where they are included, as li, 4b, etc.

Department	Man Hours Worked	Number of Accidents	No. of Employes Injured	Time Lost (Days)	No. of Employes Killed
Maintenance					
R. S. & S.		See Footnote "C" on next page			
Transportation ..					
Misc.					
TOTAL					

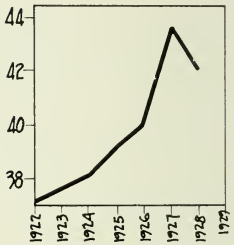
SHOWING RISING TREND OF ACCIDENT COSTS DURING THE PAST 7 YEARS & THE LARGE REDUCTION IN CLAIMS MADE IN 1928.



3A - AVG. COST PER CLAIM SETTLED



3B - AVG. COST PER SUIT



3C - % OF REPORTS ON WHICH CLAIMS MADE

3D. - NO OF CLAIMS MADE AGAINST COMPANY

NOTE "A": We have no accurate bus statistics for 1925.
NOTE "B": We have no figures to answer this question.
NOTE "C": In year 1926, reports of accidents did not segregate bus from other accidents.

COST OF ACCIDENTS

	1926	1925
5. A.—COST OF INSURANCE:—TOTAL	$ None	$ None
(1) Public Liability Insurance	None	None
(2) Property Damage	None	None
(3) Collision Insurance	None	None
(4) Any Other Accident Insurance	None	None
B—COST OF CLAIMS SETTLED BY COMPANY:—TOTAL	$37,443.74	$13,794.99
(1) For Personal Injuries	See Footnote "A"	
(2) For Property Damage	See Footnote "A"	
(3) Cost of Claims Department including Medical Service, Private Investigations, Legal Expenses in connection with Claims, etc.	See Footnote "B"	
C—ANY OTHER COSTS IN CONNECTION WITH BUS ACCIDENTS—please itemize	See Footnote "B"	

NOTE "A": No division made by this Railway.
NOTE "B": Not segregated as to buses. Included in Question 5 on Data Sheet No. 360.

STATISTICAL DATA

6. TOTAL BUS OPERATING REVENUE	$1,570,884.23	$868,836.75
7. TOTAL NUMBER OF BUS MILES OPERATED	5,146,443	2,472,456
8. NUMBER OF REVENUE PASSENGERS CARRIED	18,985,269	10,953,740
9. TOTAL NUMBER OF PASSENGERS CARRIED	31,729,918	17,202,167
10. AVERAGE TOTAL NUMBER OF BUS OPERATORS (INCLUDING CONDUCTORS)	232	122
11. AVERAGE NUMBER OF BUSES OPERATED DURING PEAK SCHEDULE	183	95
12. MILES OF BUS ROUTE OPERATED (ONE-WAY)	59.862	49.898

Date ..... Signed .....

Title .....

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APPENDICES

APPENDIX A

How the Automotive Division Secures Employee Co-operation in Accident Reduction

In the automotive division of the department of rolling-stock and shops, whenever an employee has an accident, regardless of how slight, he is requested to come to the office of the supervisor of automotive equipment and talk it over. This is not done as a matter of discipline, but in the spirit of co-operation. The two talk over the accident in detail. After it has been thoroughly discussed from all angles, the employee is asked this question: "In your opinion, could this accident have been avoided?"

From past experience, the answer to the question invariably is "Yes." The employee is then asked to explain how it could have been avoided. It is agreed by the supervisor and the employee that a large percentage of accidents could be avoided. After the interview, the employee returns to his work in fine spirits and with a determination to avoid future accidents.

All employees, when first assigned to work, are fully instructed by the supervisor in regard to accidents and safety. They are then assigned to a garage, where the foreman pilots them around the plant and points out all safety devices. They are again instructed as to how to carry on the work in an efficient manner, and at the same time to avoid accidents to themselves or to others.

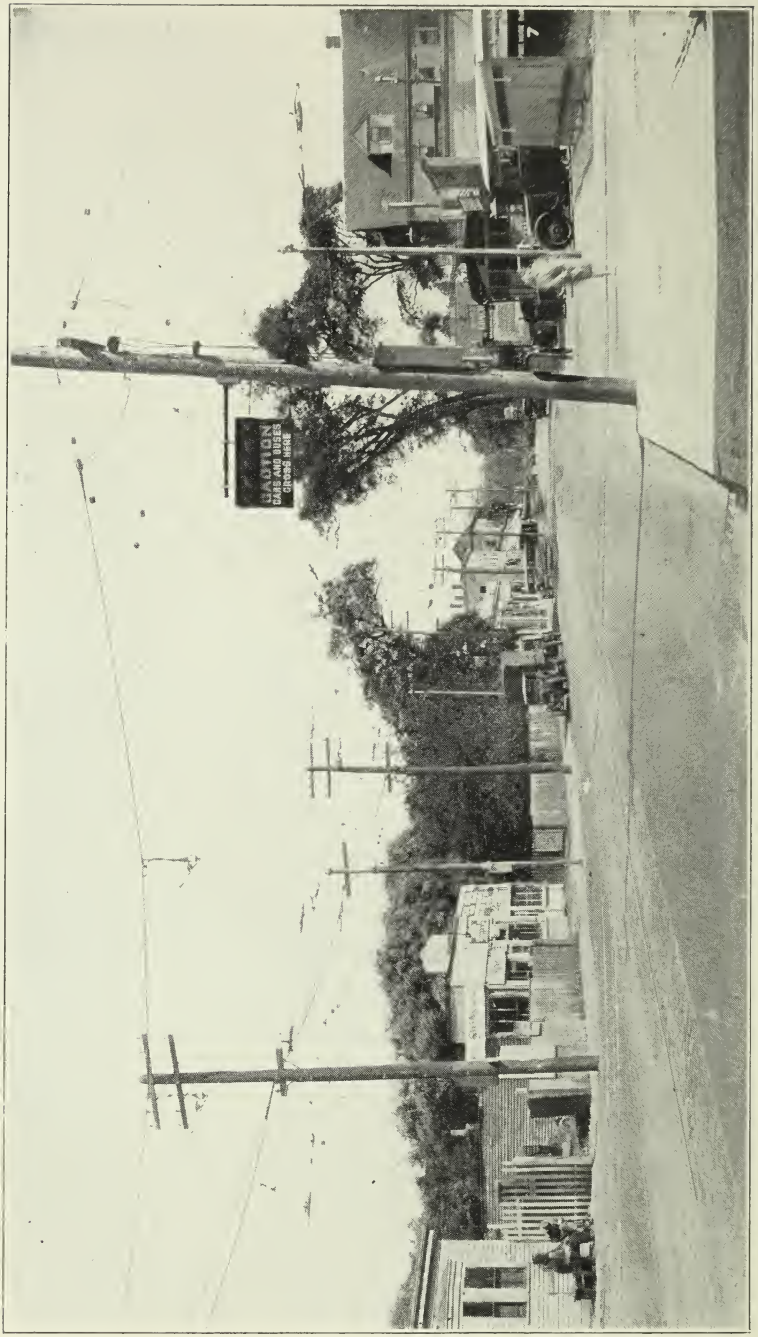
APPENDIX B

Ways in Which Track Improvements Prevent Derailments

In connection with the account of detailment reduction, given earlier, the following list of items will serve to give further detail:

1. Derailment is likely to occur if a switchpoint for any reason does not remain in the position to which it has been "thrown." In order to prevent derailments, extra heavy equipment for throwing the switches has been installed with springs to hold the points in their position. This is particularly helpful when cars are operated in trains. Also, adjustable spring-throws have been installed to hold facing-point switches when not operated electrically, and in yard tracks.

2. At points where there is heavy operation through the current side of switches, double-point switches (i. e., a combination of



Signal at Yard Entrance to Warn Automobile Drivers

tongue switch and tongue mate) have been installed to give bearing for outside wheels opposite the low part of the switch point.

3. Beds of mates and frogs have been built up and ground to take care of both points and one-way grooves, special attention being given to crossovers, curves not regularly used and runoff switches. The super-elevation of outer rails of curves, that is, the raising of these rails to offset centrifugal forces imposed by cars rounding the curves, has been checked and the rails adjusted where necessary. Extra guard rails have been installed in reservations where a derailment might cause a car to run over an embankment or wall.

4. Whenever snow and ice collect on interlocking (i.e., that part of a track layout where cars or trains are switched from a tower) an accident hazard is liable to result because a switchpoint cannot be operated properly. To prevent this condition, electric track-switch heaters have been installed to melt the snow and thus prevent an accumulation of it in the switches.

5. In some cases switches have been changed to include tongues longer than the wheel base of the truck to prevent operations between wheels of a truck.

APPENDIX C

Additional Ways in Which Car and Bus Equipment Has Been Made Safe

Supplementing the illustrations cited in the body of this presentation to show how rolling-stock is being made safer, the following are given:

1. Additional safety hangers have been installed on the sixty new Cambridge subway cars, to hold the body brake levers in place in case of breakage. Safety hangers have now been installed in practically all types of trucks to prevent brake rods or turnbuckles from dropping down in case of a broken pin or bolt.

2. On work cars, brake-lever safety stops have been installed on double trucks, and iron straps substituted for iron rods to insure safer braking operation.

3. Safety clamps have been installed on the trailer release springs on a large number of main-line car trucks to hold the springs in place in case they should break.

4. Trolley catchers have been installed on all surface cars in order to prevent damage from trolley pole and wheel if a wheel leaves the trolley wire.

5. Stationary controller handles, i. e., handles which are not detachable, have been installed on all cars, thus insuring their always being in place when required.

6. On certain cars where it was needed a transite board has been installed over resistance boxes in order to reduce fire hazard.

7. Electric tail lights were provided on main-line cars, an advanced practice over the use of oil lamps as heretofore. The tail lights are arranged so that in case of loss of power, a second set of lamps will be automatically illuminated from a battery circuit. The oil lamps were unsatisfactory because they were frequently extinguished while the car was in service. The electric tail light is installed in a cast-iron box secured to the end panels of the car. This box is provided with a sliding cover which may be readily removed for replacement of burnt-out lamps. Within the box is one standard lamp for regular use, which is in circuit with other lamps in the car. There is also one small battery lamp which is illuminated in case of loss of power.

8. On center-entrance cars, a trial installation has been made of door hangers and tracks of more substantial character than those heretofore used. These are to eliminate the accident hazard due to doors coming off the tracks while a car is in motion, and also to reduce the play due to door trouble. Use of the new hangers will be standard. The center-entrance cars are equipped with outside sliding doors and are subject to damage through coming in contact with auto trucks or other vehicles on the street. When this occurs the doors are usually broken and the door tracks are bent and distorted to the extent that the door hanger rollers will not stay on the track. The form of the tracks is such that it is difficult to straighten them so that the rollers will not jump off. As the doors are usually damaged so as to require new ones, it was felt that it would be better practice to use a more substantial hanger and track, and thus reduce the liability of the doors coming off in service with the consequent accident hazard.

9. New headlight door latches with spring locking device have been installed on surface cars and the grill work formerly used has been removed from the headlight door. This change facilitates headlight cleaning and secures full efficiency of headlight lamp.

These changes are important in view of the part played by the headlight in safety in night operation.

10. Subway and elevated cars have always been equipped with brackets and chains to guard the end door opening. The original location of these brackets and chains was such that with the doors open in summer, passengers would, during the rush hour, push out toward to the end of the bumper, leaving very little room for the guard stationed between the cars to work. These brackets and chains have been relocated so that the passengers cannot push beyond the door opening.

11. The automatic signal contacts on a large number of the Cambridge subway cars have been redesigned and a large number of them changed. The modified design is more reliable and less likely to give the signal with a door open.

12. Enameled metal hand straps have been installed on all rapid transit trains in place of leather hand straps which were liable to break and thus become accident hazards.

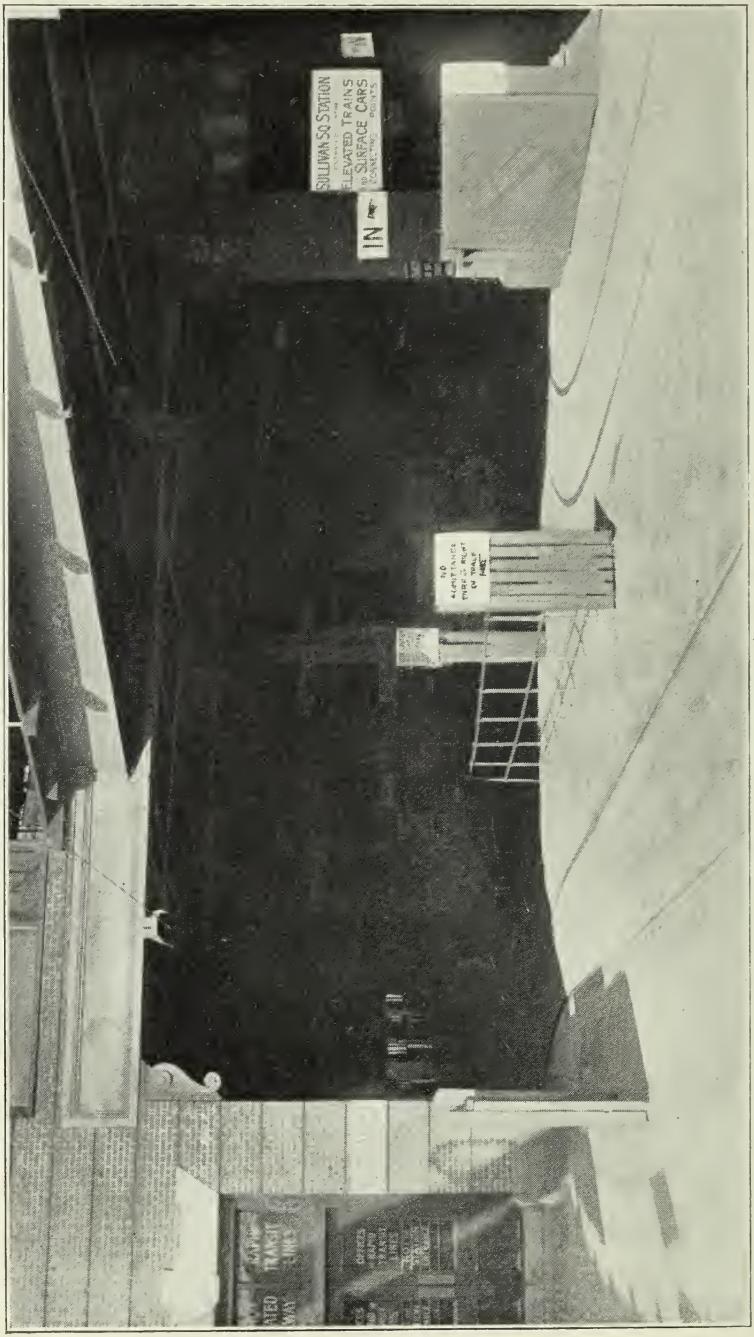
APPENDIX D

Some Contributions to Safety by the Transportation Department

Following are some ways in which accidents have been prevented in the transportation department, supplementing the items previously mentioned:

1. At one of the Railway's principal underground stations, that at Park Street in Boston, berth stops, with indicators to announce the stopping points of cars, have proved effective in eliminating accident hazard due to surging of passengers from point to point. Passengers group themselves at loading points and there is little confusion. Ample time is allowed between the announcement of the car stop on the indicator and the time of departure of the car.

2. At one of the car yards of the Boston Elevated Railway there is a narrow entrance for cars through a high wire fence. A danger hazard thus exists to pedestrians passing the yard entrance, as they might step in front of cars about to leave the yard. To eliminate the danger as nearly as possible all cars are required to stop before leaving the yard, and on iron poles located on the sidewalk the legend, "Look out for Cars," appears in white letters on a red background.



Warning Signs at Sullivan Square Terminal

3. At another point it is necessary for cars and buses to cross from the right hand side of a street to the left hand in order to enter the terminal. To apprise drivers and pedestrians of this fact, illuminated signs have been erected carrying the wording: "Cars cross here," "Buses cross here." Signs have also been erected in terminal stations warning patrons regarding the danger of crowding and pushing.

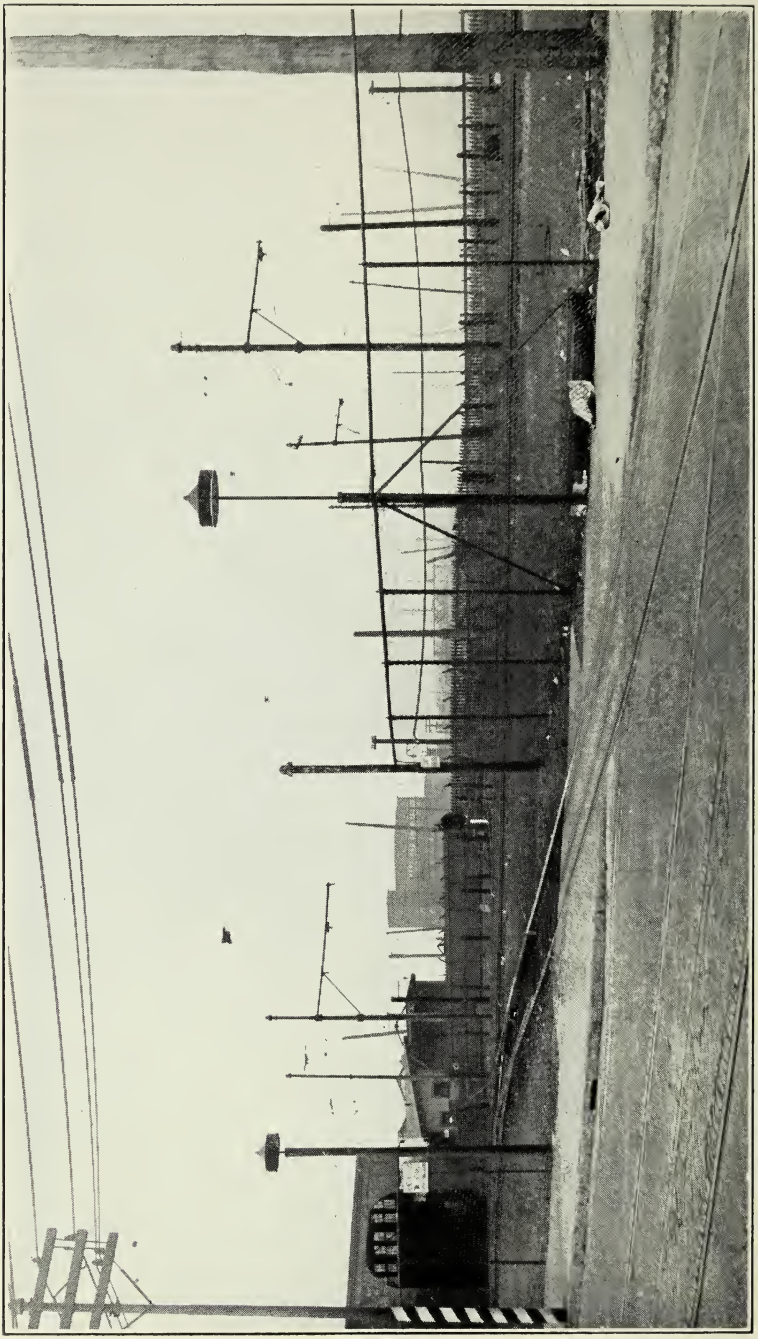
4. The Railway has had good results with clearance signs painted on sidewalks or floors to indicate the boundaries of danger areas. Such lines are provided on station platforms, placed to allow for the overhang of the cars, and nearby are signs reading: "Caution—Keep back of white line on platform." Similar clearance lines are effective in warning passengers and motorists of the swing of cars on curves in streets and at points where cars pass through narrow places. To illustrate the benefits resulting from the use of these clearance lines one location in Cambridge may be cited. In 1927, before the clearance line was painted on the roadway, there were 25 accidents at this point. In 1928, after the line had been painted in, there were only eight accidents.

5. To supplement the clearance-line warnings, dasher posters are carried occasionally on the cars and are worded: "Autoists look out for overhang of cars on curve."

6. Arbitrary "stop" and "slow" signs have been installed at dangerous intersections, also "narrow clearance" signs at points of narrow clearance. Safety "stop" signs have also been installed to control cars and buses at drawbridges and railroad crossings. Bulletin notices are posted in the lobbies at intervals, cautioning the men to operate with care and safety through narrow streets.

7. Attention may be directed at this point, although the subject is taken up in more detail elsewhere, to the improvement in methods of instruction of bus and car operators from the standpoint of accident prevention. Special track for cars and roadway for buses have been provided so that the men may have practice in avoiding accidents away from the public streets. As new men are most liable to have accidents, such instructions cannot but result in safer operation.

8. The intersection of Main Street and Mystic Avenue in Charlestown is at the foot of the Somerville incline or exit from Sullivan Square terminal upper level. This is a heavy traffic area and outbound cars making a stop before crossing railroad bridge



New Safety Lights at Car Exit at Terminals

caused congestion, while patrons waiting to board were subject to accident risk. To eliminate this condition a sign was placed on the pole at the stopping place reading: "Weekdays (except Saturdays) from 4:45 to 6:00 take Outbound cars Here."

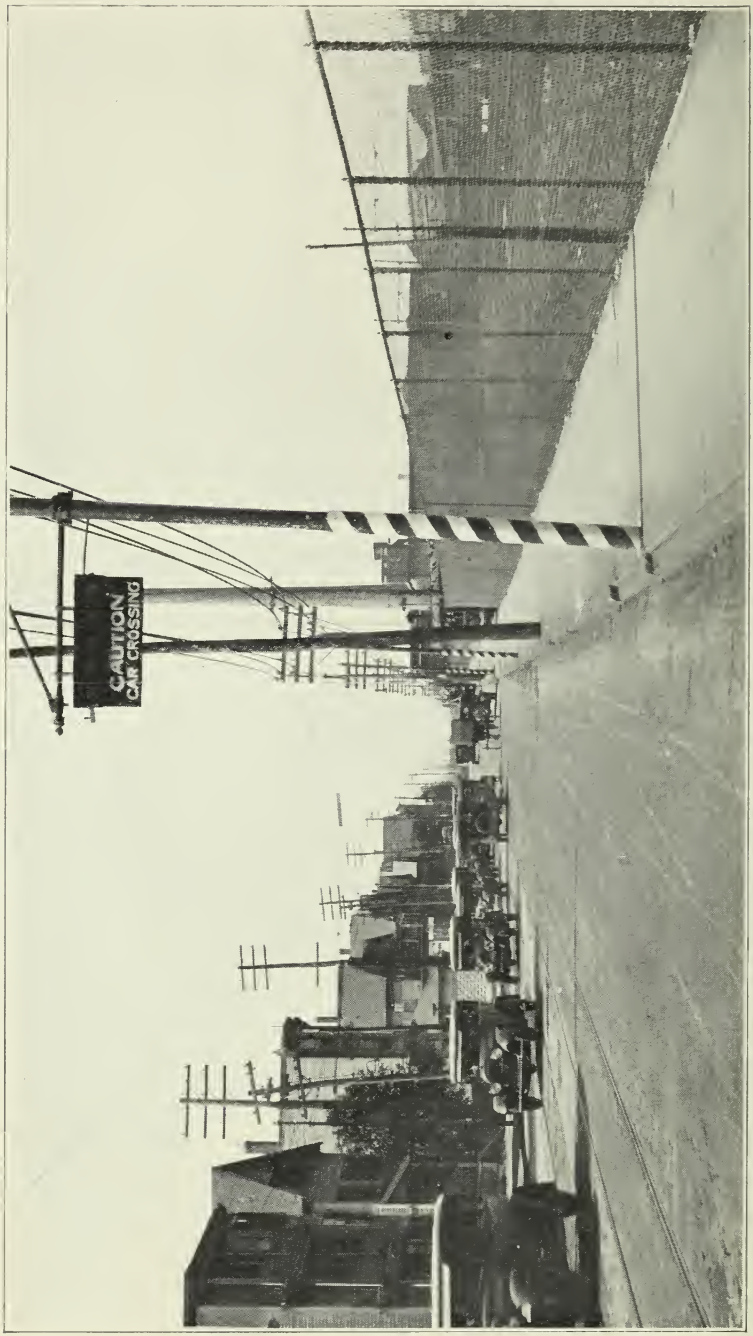
9. In connection with the above and after the installation of berth stops at Sullivan Square, upper level, signals were installed on the Elevated structure at Main Street and Mystic Avenue, to control the movement of inbound cars crossing this area. These signals are operated by an inspector on duty at this point. In addition to controlling the movement of cars through this area these signals are also utilized for the movement of cars into the terminal so that berth stops may be utilized to a greater advantage.

10. In the Fellsway, forming part 2 the Metropolitan park system, the line is operated on reservation, with rows of poplar trees on either side and on the sidewalk line. During the fall hazard is created due to the fallen leaves. At the approach of fall one man is detailed to this secton to instruct operators in regard to conditions. He also takes charge of ordering out the sand car. In addition, maintenance department men are assigned to rake up and burn leaves. This practice has resulted in reducing the number of accidents in this section.

11. A revised book of rules for trainmen and other employees of rapid transit lines was issued in August, 1928, containing a full and up-to-date code of rules for safety of operation and the comfort and convenience of passengers.

12. At Gerrish Avenue, in Chelsea, single and two-car trains are operated around a sharp turn to the right when leaving Broadway and turning into the yard located at this point. With the heavy traffic from the North Shore passing this point, many collisions occurred, vehicles colliding with the right side of cars on the curve. Cars are now required to make a safety stop before making the turn.

Conductors on single-car as well as on two-car trains have also been instructed that before starting, doors must be opened and the conductor must stand at the door with his hand extended to warn approaching motorists that the car is about to turn. This procedure has greatly reduced the number of accidents at this point.



ILLUMINATED OVERHEAD WARNING SIGNAL WITH STRIPED TROLLEY POLES AT ENTRANCE TO YARD

APPENDIX E

Other Safety Features Having to do with Tracks

In subway stations used by surface cars where the passengers board from the ground level, there was formerly an accident hazard due to the space between the edge of the platform and the nearest rail. This "brow" has now been filled in so as to make the platform practically flush with the top of the rail. This feature has also been embodied in the new Fields Corner and Ashmont stations of the Dorchester Rapid Transit, where surface cars operate into the stations.

At street intersections, squares and other places where elevated structure columns are in the line of street traffic, a hazard existed because of the possibility of drivers of vehicles being unable clearly to distinguish the columns. They have been painted with black and white diagonal stripes to increase visibility.

While not directly a track matter, it is appropriate here to refer to the sanding of bus routes by means of a sand spreader to prevent skidding. Sand spread on the highway thus greatly reduces one of the chief accident hazards in winter operation of buses.

APPENDIX F

The "El's" Educational Program and Accident Prevention

During the past three years the educational program of the Boston Elevated Railway has included a number of features bearing directly and indirectly on accident prevention. As the effect of this work has been cumulative, contributing to the increased interest in safety, it is appropriate to review the safety features of the educational program at this point.

In 1923-24 several series of departmental group conferences were held. These were open to all employees and were designed to interest them in the broad aspects of their everyday work and to permit entertainment as well.

One of the outstanding addresses in the maintenance department group, comprising two hundred or more employees, was that by Hon. Russell A. Sears, general attorney of the Railway. Mr. Sears, by the way, was awarded the Brady silver medal in 1914. His address covered the subject of accident prevention in such an effective way that he was invited to deliver it before two larger groups of transportation department employees.

RECOGNITION OF SAFE OPERATION

The general manager has sent a letter of appreciation to nearly 1100 men in the transportation department who operated cars during 1928 without an accident chargeable to them. The text follows:

It has been reported to me that you are among those men who during the year 1928 maintained a clear accident record; that is, you were not involved in an accident in which in any way you contributed to its occurrence.

It is most gratifying to find that there were 1093 men in this class, and the management takes this opportunity to express its appreciation of your carefulness. You have reason to feel proud that in the conduct of duty you had a realization of your responsibilities about you at all times.

Last year the accident cost to the car rider amounted $1,502,313, and when we realize the suffering entailed, as well as the fact that this money is, as far as the car rider is concerned, a complete waste which could be used to his advantage much better by providing added service, we can appreciate the need for exerting every possible effort to reducing this toll.

It is our hope that for your own sake, as well as the sake of the service, you will continue this good work and that in other respects also your year may be a pleasant one for you.

Very truly yours,

EDWARD DANA,
General Manager.

LETTER FROM GENERAL MANAGER TO MEN WITH EXCEPTIONAL ACCIDENT RECORDS

John J. Reynolds, claims attorney, also addressed the latter groups on the subject of accident reports.

Mr. Sears was delighted by the interest shown in his address and he conceived a plan for reaching the entire force of four thousand carmen, who, on account of their duties, could not be reached in person, by means of a series of imaginary meetings, the reports of which were sent serially, one each week to the men at their homes. This plan was carried out early in 1925.

There were ten of these "meetings," each "addressed" by a member of the general attorney's staff. The reports were printed in uniform size and style, suitable for binding. As was announced at the outset, after the close of the series an opportunity was afforded the men to take examinations upon the "addresses." The grading was to be based on the content of the answers, ignoring unity, composition and spelling. Two employees in each of the four surface-lines divisions and two employees in the rapid transit division,

whose examination papers proved to be the best and whose accident record from Jan. 1, 1925, had been meritorious, were promised a reward. Each examination comprised twenty questions, including both general and practical topics. They were reproduced in a pamphlet, entitled "A Co-operative Plan for Accident Prevention," which also contained the ten addresses. An introductory statement from the general manager outlining the scope and purpose of the campaign is included as an exhibit.

The reward which each successful contestant received was a trip to the 14th Annual Safety Congress of the National Safety Council, held in Cleveland, Ohio. The delegation of ten men comprised conductors, motormen, bus operators, and one guard.

The success of the 1925 competition led to a supplementary plan for 1926. The "addresses" of the previous year were printed attractively in pamphlet form, with the examination questions, and copies were mailed on Feb. 1, 1926, to the homes of all car men. They were offered the opportunity to take an examination on the "addresses."

In an introduction to the reprint the general manager explained that the answers to every question could be found in the "addresses," the rule book or the experience of the car, train or bus-service man.

The reward promised was a trip to the 15th National Safety Congress to be held in Detroit, for one motorman, one conductor and one bus operator for each of the surface line divisions and one motorman and one guard from the rapid transit division. Fifteen delegates were actually sent. These men constituted "Class A" in the competition. Following is the text of the introduction to the reprint:

(Read this first.)

THE 1926 ACCIDENT-PREVENTION CAMPAIGN

A highly successful plan was used last year to interest car and train service men in accident mitigation. The story is told in the accompanying booklet. Ten "talks" by well-qualified persons formed the basis of the program.

The same "talks" will be used this year, but are distributed in one pamphlet instead of being sent serially to the homes of the

men. *These "talks" will be used as the basis of an examination to be held in May,* 1926.

In the accompanying pamplet are reprinted the examination questions used last year. For every question asked the answer can be found in the "talks," the rule-book or the common-sense of the car, train or bus-service man. The questions to be used at the examination in May, 1926, *will, in substance, be the same* as were asked last year. Of course, they may be worded differently and not come in the same order, but if you know the answers to the questions as *now* printed, *you need not have any fear* that you cannot answer the questions put next May.

The examination will, as formerly, be held in the instruction school at Sullivan Square, where there will be plenty of room and all material provided. For convenience, the examination will be held in two shifts—one in the morning and one at night.

The best sets of answers of one motorman, one conductor and one bus operator from each of the surface divisions, and the best sets of answers of one motorman and one guard from the rapid-transit division—and whose accident records are meritorious from Jan. 1, 1926—will, in recognition of their success, be sent as delegates from the Railway to the National Safety Congress to be held next fall. These men will constitute Class A.

The next best 100 papers—twenty from each division, being divided as nearly equally as possible in each surface division among motormen, conductors and bus operators and in the rapid transit division between motormen and guards—whose accident records from Jan. 1, 1926, are meritorious—will be given a ten-dollar gold piece. These men will constitute Class B.

The winners in the examination of last year will not be eligible for the Class A recognition but will be for Class B.

Handwriting, spelling or grammar will not be taken into consideration.

Now is the time to prepare. Read these "talks" over from time to time, then turn over to the back of the book, pick out questions at random and see if you can answer them as they should be answered. If you can, well and good; if you cannot, re-read your papers until you get the answers that you know are correct. If this is done every few days you ought to know the whole matter forward and backward and have fear of no one putting a question to you concerning accidents on our railway that you cannot answer. By

knowing the answers you will know what to do and if you do it you will have fewer accidents, to the great benefit of the public and all of us.

EDWARD DANA,
General Manager.

In addition to the above the writers of the next best 100 papers, twenty from each division, who were designated as Class B men, were each given a $10 gold piece.

The stimulus resulting from all this activity was not confined to the men directly concerned. Through the employees' monthly bulletin, distributed to all employees and many others, information regarding this accident reduction campaign was given wide circulation.

Returning now to the group conferences, Mr. Sears' address was also presented before a series of conferences of women employees, making a total of four groups which heard it. These addresses were the most conspicuous accident-prevention efforts of 1925 and 1926, but other speakers in the conferences stressed the same subject from different angles.

After the close of the campaign the best answers to questions in the examination were compiled and printed serially in "Cooperation," under the topics:

What makes a good accident report?
Keep out of the way of fire apparatus.
Children playing in the street—an accident hazard.
More good answers to the examination questions.
How could money wasted in accidents be used to advantage?
Safe position for an alighting passenger.
Why is accident expense sheer waste?
More answers from the accident-prevention examination.
Accident prevention in bus operation.

Realizing the interest that had been manifested in accident prevention during the preceding season, the Elevated committee on education arranged for a series of ten lecture-conferences on the subject for the following season. As chairman, John J. Reynolds, claims attorney, was selected and under his leadership a remarkable course was conducted. The topics and speakers were as follows:

Accident Prevention—Humanity's Most Urgent Need, by John J. Reynolds, chairman of the series.

Human Waste in Industry, by Jones I. J. Corrigan, S.J., Boston College.

The Moral Effect of Accidents, by L. E. MacBrayne, general manager, Massachusetts Safety Council.

Accidents of the Future, by David S. Beyer, Liberty Mutual Insurance Company, Boston.

The Mental Causes of Accidents, by Prof. Edwin M. Chamberlain, Boston University.

The Hoover Conference on Street and Highway Safety, by Hon. Russell A. Sears, general attorney, Boston Elevated Railway.

The A B C of Accident Law, by C. W. Mulcahy, Esq., attorney at law, Boston.

Relation of the Merit System to Accident Prevention, by H. K. Bennett, safety manager United Electric Railways, Providence, R. I.

Safety Education in the Public Schools, by John C. Brodhead, assistant superintendent of schools, Boston.

In this course the formal exercises were usually followed by motion pictures, sometimes of a safety character, sometimes merely entertaining. At one meeting more than 500 persons were present.

At each meeting the chairman, in introducing the speaker, reviewed the subjects previously covered and thus gave continuity to the whole program. The chairman's introductory address was reprinted in full in the May, 1926, issue of AERA, the monthly magazine of the American Electric Railway Association, thus reaching a still wider audience. Stenographic reports of all of the meetings are preserved in bound volumes in the library of the Railway, where they are conveniently available for reference.

During the same educational season (1925-26), a course in first-aid was given as part of the program, under the leadership of Dr. Benjamin E. Sibley, the Railway physician.

The course covered such topics as the stopping of blood flow by the use of the tourniquet, the inducing of artificial respiration by the Schaeffer prone-pressure method, etc. The purpose was to enable employees to render service in emergency to fellow employees, to the public and to their neighbors and friends.

The instruction was of a practical nature, all members of the class having practice in bandaging, applying prone-pressure, etc.

At the closing exercises of this season, when certificates were awarded to those completing courses, due prominence was given to the subject of accident prevention. On the program were L. E. MacBrayne, general manager, Massachusetts Safety Council, and R. C. Bush, manager Transit Mutual Insurance Company, through which compensation insurance is paid by the Railway.

"Accident Prevention" in the Foreman Conferences

Simultaneously with the giving of the accident-prevention course, the Boston Elevated began its foreman conferences. These have been conducted since, always with increasing interest and enthusiasm. An outstanding topic in these conferences is always that of accident prevention, usually phrased "Reducing Carelessness on the Job."

In the foreman-conference discussions of carelessness the aim is to analyze, or segregate, what may be termed "carelessness factors," and then to formulate means for minimizing the effects of these factors, or if possible, eliminating them. An abstract of a typical discussion on the subject is inserted below.

In every season's educational program, accident prevention has received consideration. Thus, in the season of 1927-'8, General Manager Edward Dana discussed the accident problem in an address on "Some Interesting Problems to be Solved." This was delivered before two transportation groups and was later published in "Co-operation." In this address he explained the efforts of the Railway to reduce accidents, and enunciated the principle that the aim is to train high-accident men to avoid accidents and particularly to study the causes of frequently recurring accidents of the same type. He said, "We want to save the men for the Railway."

MINUTES OF THE SEVENTH FOREMEN'S CONFERENCE

Course G-2 February 1, 1929.

The discussion on "Accident Prevention," a continuation of "Reducing Carelessness on the Job," was continued at this meeting under the leadership of Dr. C. S. Slocombe, safety advisor of the Railway.

Dr. Slocombe explained the details of the successful efforts which have been made during the past year and a half to reduce accidents on the surface lines. He said that in 1927 there were

2,300 motormen and operators on the surface lines, of whom 1,828 operated safely, that is, they have fewer than five accidents per year. There were 472 men with five or more accidents per year. During 1928 the number of high-accident men was reduced to 295, which included 135 of the men who were not high-accident men during the preceding year.

Dr. Slocombe called attention to the fact that of all accidents 95 per cent may be classed as minor accidents, while only 5 per cent are serious. However, it is important to pay close attention to minor accidents for several reasons:

1. In the first place, the aggregate of claims resulting from minor accidents is considerable.

2. A man who has a great many small accidents is likely at some time to have a serious accident.

There are about 20,000 accident reports filed per year. Although, as stated above, a small proportion of the accident claims are important yet about 8,000 claims are filed per year and of these from four to five thousand require damages in settlement.

One noticeable feature of the accident characteristics of motormen and operators is that when a man's record is good one year, it is apt to be good year after year. The same thing is true with those having bad accident records.

The men who have few accidents, less than five per year, are the ones who set the accident standards for the road. The idea is to get all of the operators into this class and gradually to raise the standard.

There was considerable discussion as to whether a man who has many small accidents is likely to have big ones, but no illustrations were brought up to disprove the truth of this statement.

Procedure in Accident Reduction

When a man comes into the high-accident class, his record is examined to see if there is any possible explanation. Sometimes the records or statements by the motormen or operators give a clue to the cause. In one case a man operated a heavy car on Sunday afternoons, while he operated a light car at other times. He had had collisions due to his inability to stop the heavy cars as quickly as he did the light ones. Here was an obvious explanation of his high accident record on Sunday afternoons.

In most cases, however, the explanation is not so obvious. Sometimes the difficulty is with the eyesight and fitting with proper glasses solves the problem. Sometimes medical attention is needed. Trouble at home is occasionally the cause for worry and results in accidents. Then, men differ in their ability as car operators.

One outstanding feature of this work is to avoid the necessity for discharging a man if possible. Aside from a desire to retain a man who has had experience, there is the investment in training for this particular work to be considered. In some cases a small additional investment in training will make a safe operator.

There was a lively discussion on the numerous causes of accidents, sometimes dealing with the men and sometimes with the equipment. Some men had suggestions to make and it was recommended that some of these be taken up with their superiors.

On the whole, the discussion was one of the most profitable that has been held to date.

Attention of the men in G-2 is directed to the reading of the leading article in "Co-operation" for January, 1929, which covers the record of the Railway in accident reduction in 1928. This issue should be in the hands of all members of the group before these minutes are received.

As an appendix to these minutes are given some notes on rapid-transit line accidents, prepared for this purpose by D. D. Hall, assistant superintendent R. T. L.

E. A. Kelley,
H. H. Norris,
Conference Leaders.

Appendix to G-2 Minutes

ACCIDENTS ON RAPID TRANSIT LINES

By D. D. Hall, *Asst. Supt. R. T. L.*

Guards must carefully observe doors before closing to see that no one is getting in or out, or is in position to be struck. Passengers will step into car, change their minds and back out. Passengers will also rush headlong from stairways, passageways and from behind posts, with no regard for their own safety and try to beat the door to it. Sometimes one will stick his hand, foot, umbrella or bag into a closing door and try to force it open. When the guard neglects

to watch his door properly before starting to close it or to continue to look out while it closes, he may not see these acts and be able to act quickly and prevent accident; even when the passenger has no regard for his own safety and rushes headlong into a closing door, the guard may prevent or, at least, minimize the blow by being alert to reverse the door before it strikes or squeezes the careless passenger.

A man may watch his doors without losing an appreciable amount of time by closing all on one car at about the same time and keeping his eyes in the general direction that covers the three doors, then quickly turning to the other car and operating in the same manner. One cause for accident is facing one door and reaching behind to operate a button for a door not in view. There is obviously no protection when one rushes headlong for such a door.

The requirement that guards remain out between the car looking over the gates until the train actually moves applies whether crowded or not and is necessary for many reasons. If something suddenly happens the guard is out where he can quickly reach the emergency valve, whereas if he stands inside the car as soon as his doors are closed and anything happens when the train starts, he loses time in getting out in a position to act. He should also remain out so as to be in position to receive and pass the hand motion in case of automatic signal failure.

Fingers closed in end body door

Some accidents are caused by end body door closing on passenger's fingers, passengers reaching up to catch door jamb as train rounds curve or accidentally places their hand in door jamb. Fasteners are provided for holding the door open and doors when opened at all should be fully opened so as to engage these fastenings. When door is to be closed it should be faced and care taken to see that no one's fingers are in the door jamb.

Accidents are caused by passing through this door and taking hold of the grab handle from behind and closing it without looking at it.

Passengers falling due to opening door

Passengers depend upon us for their safety and when door is opened are inclined to step out without noticing whether train is moving or not. Guards must keep doors closed until train stops,

but must act quickly and open door as soon as possible when train does stop. Guards must also notice that door stops abreast of a safe place, that train has not stopped short or run by platform and if at wide space, that sliding platform has been projected.

Another example is an address in the program of 1928-'29, also delivered before the transportation department groups, by Col. W. V. Bingham, director of the Personnel Research Federation, of New York. This was entitled "1928 a Banner Year for Safety." Colonel Bingham described, with the aid of convincing graphs, the program which had recently been made as a result of careful research. His remarks, with illustrations, were promptly published in "Co-operation."

"Co-operation" Plays a Prominent Part

As has already been suggested several times, the monthly bulletin, "Co-operation," serves to disseminate the information on accident prevention throughout the employees and beyond. In 1928 the Railway began the practice of mailing the publication to employees' homes, thus greatly increasing its appeal and insuring complete coverage.

For several years "Co-operation" has carried accident data on the back cover of each issue in rate form; i. e., accidents per 10,000 car-miles, accidents per 10,000 bus-miles and revenue-passengers per accident. These data are graphed from time to time by way of review and emphasis.

Mr. Dana devotes a prominent page of each issue of "Co-operation" to a brief, pointed editorial on some topic of vital importance. Frequently the topic is accident prevention. Thus in January, 1926, he wrote that the challenge of the new year was four fold, to greater achievement in courtesy, safety, waste elimination and teamwork. In a following issue the message dealt with what safety means.

During the following year, three messages dealt with this subject. In the first, the importance of making safety an individual matter was stressed. In the second the new campaign to reduce accidents on the Railway was explained, and this was followed, in the issue succeeding, with a call to the employees to back up the campaign.

The accompanying illustrations show how these messages are displayed to attract attention.

On Oct. 22, 1926, Mr. Dana addressed over the radio the "Big Brother Club," taking for his topic, "Accident Prevention." This talk was published at once in "Co-operation." In connection with the talk he offered twenty $5 gold pieces as prizes to as many young people for the best verses on being careful and preventing accidents on the highway.

"Co-operation" printed many of the contributions in the contest.

Another radio talk, on "Winter Safety on the 'El,'" was also printed in "Co-operation."

In view of the importance of the subject, "Co-operation" features articles on safety whenever available. Thus, when the department of maintenance of the Railway was planning a "No-accident Week" in 1927 the plan and the results were recorded. In March, 1929, a chart giving graphical record back to the beginning of 1926 was reproduced, accompanied by an analysis of the ways in which accidents had been reduced. An account of this activity of the maintenance department is given elsewhere in the presentation.

The above summary will serve to indicate the importance of the place of the monthly bulletin in accident reduction. It furnishes the only available means of direct communication between the management and the employees, hence affords an excellent vehicle for factual and informational messages.

This ends the presentation as made to the Committee on Award of the Anthony N. Brady Memorial Medals.

APPENDIX G

Continued Progress During 1929

As this reprint is appearing after the 1929 safety record is complete, it has been deemed allowable to include a brief summary of this record. During 1929, the Railway continued its accident reduction and prevention work on substantially the same basis as the two previous years. During 1929 the same noteworthy success was achieved in accident prevention. Following is a classification of surface car and bus accidents in accordance with the method followed by the American Electric Railway Association:

CARS

	1929	1928
Number of accidents per 10,000,000 car-miles operated	3083	3230
Collisions with motor vehicles per 10,000,000 car-miles operated	899	1023
Collisions with cars per 10,000,000 car-miles operated	24	27
Collisions with other vehicles per 10,000,000 car-miles operated	30	35
Collisions at railroad crossings per 10,000 000 car-miles operated	0	0
Collisions with pedestrians per 10,000,000 car-miles operated	36	47
Derailments per 10,000,000 car-miles operated	37	39
Boarding & alighting accidents per 100,000,000 passengers carried	125	164
Accidents on cars per 100,000,000 passengers carried	333	375

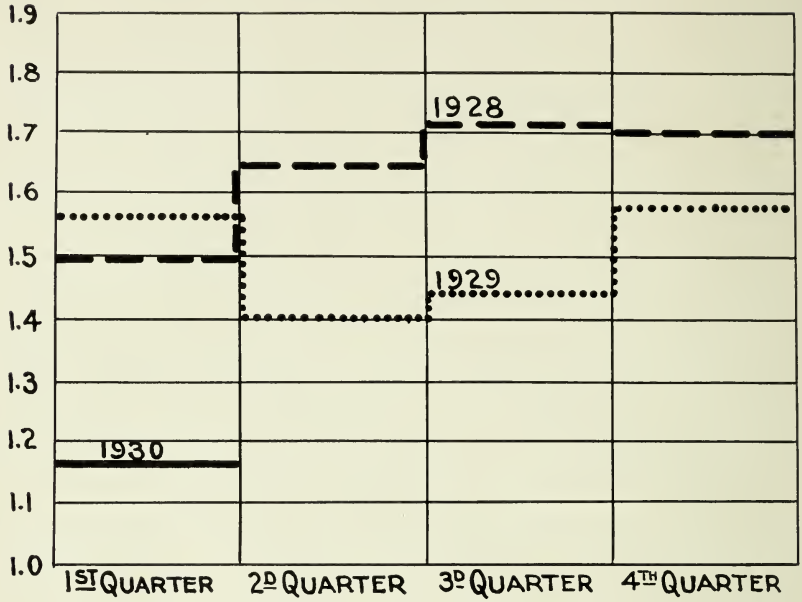
BUSES

Number of accidents per 10,000,000 bus-miles operated	2856	2819
Collisions with autos or motor trucks per 10,000,000 bus-miles operated	1423	1454
Bus collisions per 10,000,000 bus-miles operated	21	29
Collisions with trolley cars per 10,000,000 bus-miles operated	35	35
Collisions with other vehicles per 10,000,000 bus-miles operated	48	43
Collisions with pedestrians per 10,000,000 bus-miles operated	55	50
Boarding & alighting accidents per 100,000,000 passengers carried	313	344
Accidents within buses per 100,000,000 passengers carried	252	233

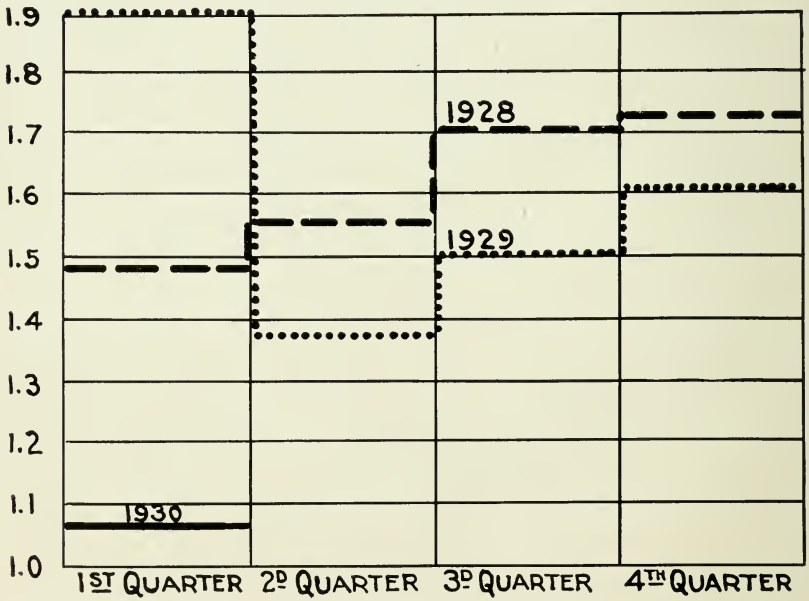
The table shows an important reduction in the total number of surface car accidents and in all classes of surface car accidents. A comparison of the surface car accidents on a mileage and passenger basis, as classified by the American Electric Railway Association, for the Boston Elevated Railway during 1928 with those in about 100 city companies throughout the United States in the same year discloses the fact that the accidents for the Boston Elevated Railway were about 50 per cent of the accidents for the city companies as a whole.

The figures for bus accidents show that the Boston Elevated Railway maintained in 1929 the total bus accident figures at about the same level as in 1928. The bus collision accidents in 1929 were 1,582 compared to 1,611 in 1928. In the class of bus accidents more likely to be of a serious nature, there has thus been a decrease in

Street Car Collisions Per 10,000 Miles



Bus Collisions Per 10,000 Miles



accidents. In this connection it is well to keep in mind that with the increase in bus mileage from 6,533,000 miles operated in 1928 to 7,670,000 miles operated in 1929, a number of new men were trained to operate buses during 1929.

In 1929 no person while actually a passenger on the rapid transit lines met death from accident, whereas in 1928 there were three passenger deaths from a rapid transit derailment accident. The passenger fatalities here reported occurred from persons either jumping or falling in the train pits or falling down in subway or elevated trains, or attempting to board a tunnel train after the door was closed. In no way are these due to any factors within the control of the Railway.

Perhaps in no more striking way can the record of the Boston Elevated in safe operation be told than by stating that in 1929 not one of the 354,200,000 revenue passengers, actually riding in the surface cars, buses or rapid transit trains of the Boston Elevated Railway, met death from accident.

In the prevention and reduction of accidents to the public, the Boston Elevated Railway during 1929 applied the same methods so successful in 1928. Study of the individual, and the effective carrying out of a carefully thought out safety plan fitted into the needs of this railway are responsible for the success of the Boston Elevated Railway in the field of prevention and reduction of accidents.

The 1929 record as to safety and health of the "El" employees is reflected in the reduction in the premium rate for industrial accidents per $100 payroll.

The following table shows the premium rate per $100 payroll on account of accidents to employees on the Boston Elevated Railway:

Classification	1920 *Per* $100 *Payroll*	1929 *Per* $100 *Payroll*	1930 *Per* $100 *Payroll*
Office employees	$0.105	$0.052	$0.036
Shop employees	1.513	1.450	1.025
All others	1.673	1.124	0.792

It will be noted that the premium rate for employees was reduced by 31 per cent in 1930 compared to 1929, and by 66 per cent in 1930 compared to 1920. The rate for shop employees was reduced by 29 per cent in 1930 compared to 1929 and by 32 per cent in 1930 compared to 1920. The rate for all other employees was reduced by 29½ per cent in 1930 compared to 1929, and by 53 per cent in 1930 compared to 1920.

The advance premium for 1930, based upon the accident experience of the Railway, was $130,000. The advance premium in 1929 was $190,000. The difference, more than 30 per cent, reflects the safety of the equipment and the effectiveness of the measures taken to guard the health and safety of the employees of this Railway. The loss ratio in 1929 was actually 50 per cent of the premium paid. The premium is fixed by the Massachusetts Rating and Inspection Bureau under the supervision of the Commissioner of Banking and Insurance of the Commonwealth of Massachusetts. This reduction in the cost of industrial accidents to the Boston Elevated Railway has been achieved in the face of increased payments under the Workmen's Compensation Act and of more liberal interpretation of its provisions in favor of the employees.

Safety in plant, equipment and practices is the explanation of this record in reducing industrial accidents.

The success of any accident prevention program can be most specifically expressed in financial terms. By reason of the reduction in the number and seriousness of accidents, the Boston Elevated Railway was able in 1929, compared to 1928, to reduce by $300,000 the amount set aside in its reserve to meet the cost of accidents to the public.

In 1929 the Boston Elevated Railway benefited from a more complete realization of its safety program than in any other previous year. Due to the late filing and settlement of claims and to the carrying over of claims incurred before the inauguration of its present safety plan, it has not been possible yet to benefit in full measure from the reduction in the number and seriousness of accidents.

The year 1929 demonstrated beyond doubt the essential soundness of the Boston Elevated safety program, the efficient and effective way in which it was being carried out, and the return in the way of reduced cost and reduced suffering to the public and to the Boston Elevated employees by reason of this work. The report of accidents for the first three months of 1930, visible on the accompanying charts, are only added proof.